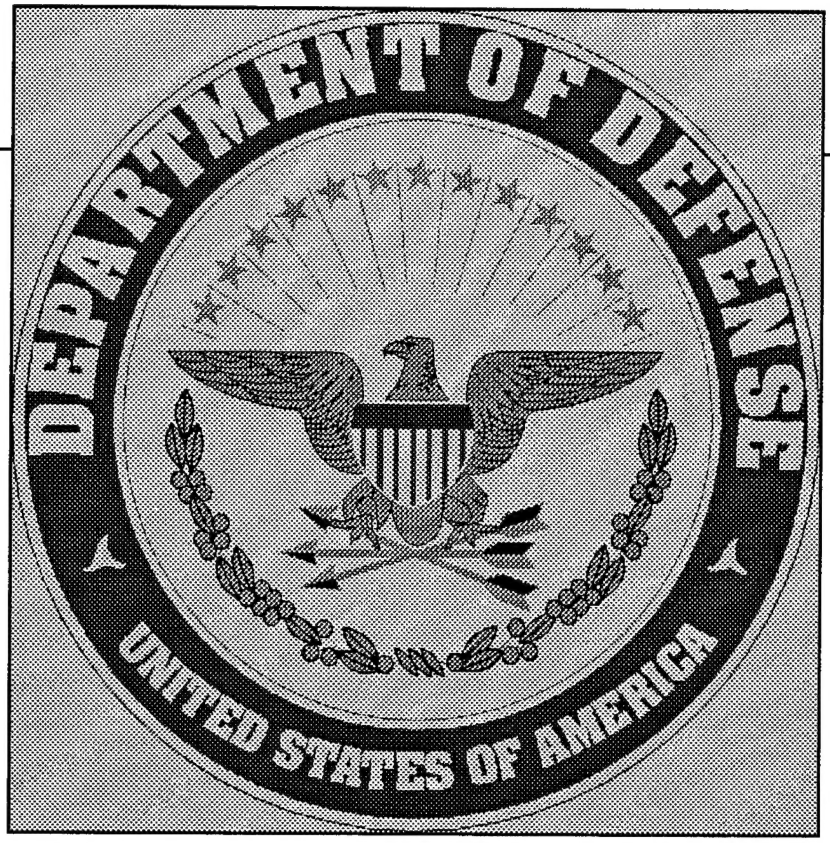


# CAIS STANDARD MANUAL

# SYSTEM NO. 20
# TRACKWORK



*CAS PROJECT*
*CAIS MANUAL*

*Issued April 28, 1995*

8 Mar 96

MEMORANDUM FOR DTIC-OCP
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SUBJECT: Transmision of Technical Documents

1. As per telephone conversation with Andrew Poulis, EQ/TIC, the attached CAIS CTDS manuals are forwarded for accession, cataloging, and microconversions. Please forward the accession numbers to:

Andrew Poulis
AL/EQ/TIC
139 Barnes Drive. Suite 2
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2. The Distribution statement should read as follows: Approved for Public Release: Distribution Unlimited.

3. If you have questions about these documents, please contact Andrew Poulis at DSN 523-6285.

Larry L. Testerman

LARRY L. TESTERMAN
Scientific and Technical
Information Program Manager

Atchs: Manuals

# 20 TRACKWORK

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# 20 TRACKWORK

## ABSTRACT

## GENERAL ORGANIZATION

At this installation the list of facilities to be surveyed, including infrastructure, will be addressed on the basis of 32 unique systems that form the CAIS Engineering Deficiency Standards and Inspection Methods document. Each system deals with a specific technical aspect of the facility to be surveyed. Within each system a further breakdown is made to subsystems, each having a related list of components. Detailed observations of the listed defects are provided so as to allow the entry of observed quantification data. A DOD CAIS manual is provided for each of the 32 systems with an internal organization as outlined below:

## INSPECTOR'S GUIDE

I. General
   - A. Level I Inspection Method Description
   - B. Level II Inspection Method Description
   - C. Level III Inspection Method Description

II. General Inspection
   - A. Process. This section describes the process of the inspection activity.
   - B. Location. This section describes the procedure for locating the inspection units in the facility or infrastructure on this installation.

III. Inspector Qualifications
   This section notes the minimum qualifications for the person or persons performing the survey.

IV. Inspection Unit
   This section describes how the IU (Inspection Unit) is determined for the particular component being surveyed.

V. Unit Costs
   This section notes the nature of repair costs for this system.

VI. Standard Safety Requirements
   This section lists safety procedures and equipment required to implement a safe environment for the conduct of this survey.

VII. Standard Tools
   This section lists a set of standard tools required for the general conduct of this survey.

VIII. Special Tools and Equipment Requirements
   This section refers to special tools or equipment requirements endemic to the nature of the system being surveyed.

IX. Level II Inspection Method Keys
   This section explains and locates Level II Key sheets.

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X. Level III Inspection Method Keys
This section explains and locates Level III Key sheets.

XI. Replacement Cost
This section describes the nature and location of replacement cost data.

XII. Appendices
Appendix A. Provides a summary and definition of all abbreviations used both in the Standards and in the data base.

Appendix B. Provides a glossary of terms with their definitions as used in the Standard.

Appendix C. This section contains a listing of the average life cycle durations for each assembly* in the Standard.

* Assembly is a term describing the level at which replacement rather than repair occurs. This can be at the subsystem or component designation, depending on the system being surveyed.

## SYSTEM TREE

The System Tree is a graphical representation of the Work Breakdown Structure, showing system, subsystem and component relationships for the Trackwork System.

## INSPECTION METHODS

Description
Describes the nature of what is to be condition surveyed.

Special Tool and Equipment Requirements
Lists any special tools required for this specific subsystem.

Special Safety Requirements
This section outlines any special safety measures or equipment required for this specific subsystem so as to maintain a safe environment and process in the conduct of the condition survey.

Component List
All components to be surveyed under this subsystem are listed here.

Related Subsystems
All other subsystems that have a survey relationship to this subsystem are listed here to help coordinate a complete and thorough condition assessment survey.

Standard Inspection Procedure
This statement indicates the various levels of survey effort required for this subsystem.

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Components

The previously listed components of this subsystem are described with a survey procedure recommended on a component by component basis. For each component there is a listing of defects with each defect broken down into observations describing the nature and severity of the defective condition observed. The surveyor enters a quantification value for each defect/observation encountered in the field CAIS device (DCD) to record the result of his survey.

References

This page lists the reference sources from which the foregoing subsystem data was developed.

Guide Sheet Control Number

This section lists the key numbers that tie the written Level II and Level III guide sheets to specific components in this subsystem.

Level III Inspection Method Guide Sheets

This section contains the detailed descriptions of the Level III survey and inspection procedures for this subsystem.

# 20 TRACKWORK

## INSPECTOR'S GUIDE

## I. GENERAL

### A. Level I Inspection Method

For Trackwork, the inspector will conduct a thorough inspection of trackwork facilities as described in the Work Breakdown Structure (WBS). Trackwork Level I Inspection is essentially a general walk-by inspection taking measurements. Measurements will be taken using a track gage-level and a six foot rule requiring only one person to take measurements.

### B. Level II Inspection Method

For Level II inspections of Trackwork, the inspector will be conducting detailed investigation of components that appear to be in non-conformance with the standards. Surveying and string lining is used where the geometric alignment is in question for operating speeds. Other calculations include a series of cross level measurements to determine track warp.

### C. Level III Inspection Method

For Trackwork, Level III Inspections shall include advanced method testing for internal defects. This requires induction or ultrasonic test equipment. Equipment and trained personnel for these types of testing is normally available from several outside contracting sources.

## II. GENERAL INSPECTION

### A. Process

Inspection will normally be conducted at the component level for a segment of track. Figure 20-A, as shown at the end of the Inspector's Guide, provides the DS/IM organization through component for Trackwork.

The inspector will work through the WBS that is represented in each track segment. At the component level, the inspector will be provided a list of defects with observations.

### B. Location

Level I and II inspections will be located by the inspector through a discrete entry into the Data Collection Device. The "IU" location will be derived from Facility-supplied segment numbering lists, maps or other I.D. numbering systems. In the case where no maps, or plans are available the inspector shall enter a brief (65 character) description of location.

# 20 TRACKWORK

## III. INSPECTOR QUALIFICATIONS

Minimum inspection qualifications for the Trackwork system require a five-year journeyman. Experience or familiarity in the areas of railroads, drainage, bridges, and building clearances is desirable but not required. All Level I inspection requirements can be accomplished by a single inspector, however, safety and other considerations may require inspectors to work in teams. Inspectors will be specifically trained in the CAS system and its usage and will be CAS certified.

## IV. INSPECTION UNIT (IU)

The trackwork facilities are to be inspected by track segments and by station location. Track segments shall be designated by usage; running track, the main track connecting to a common carrier (railroad) and the net work of other tracks at a facility. The running track will be divided into fundamental management units and then subdivided into inspection sections. Sections for the running track are also to be provided, sectioning begins at the point of ownership between the connecting railroad and the facility running (main) track and continuing to the end of the track. Other tracks include auxiliary, loading, service and storage tracks. These tracks may have one or more sections and will be sectioned beginning at their point switch in the connecting track.

The track sections designated to be inspected will be agreed upon jointly between the inspector and the facility manager.

Typically, an inspection section for running track, main track, and other track as defined above will be five (5) rail lengths of 39 feet each, or 195 feet long. Consequently, the IU for a particular track inspection section will be 195 feet.

The "Total Quantity Measured" or density prompt while recording quantities inspected in the Data Collection Device is not necessarily the same as the IU quantity. The "Total Quantity Measured" or density input should be equal to the total size or quantity of component or object being surveyed within a particular track section. Therefore, the "Total Quantity Measured" within an IU (or track segment) will vary depending on the unit of measure (UOM) for that particular observation as designated in the DS/IM.

## V. UNIT COSTS

The unit costs that are applied to the quantities recorded for each observation are contained within the Site CAIS as repair cost.

# 20 TRACKWORK

## VI. STANDARD SAFETY REQUIREMENTS

Prior to inspection of Trackwork, the authority having jurisdiction shall be notified to secure proper access, safety briefings and personal safety items. Inspector shall be alert for train movement.

The Master Safety Plan will be followed at all times during the condition survey.

Inspector may utilize the following protective gear:

- Hard hat - to be worn during all inspections
- Safety glasses - to be worn during all inspections

## VII. STANDARD TOOLS

Data Collection Device (DCD)
Battery pack for DCD
Combination track level/gage
Six foot folding rule with inches and tenths
50 foot tape
Hand Odometer
Hammer

## VIII. SPECIAL TOOLS AND EQUIPMENT REQUIREMENTS

18 inch straightedge
62 foot string
Taper gauge
Calipers

At the subsystem level, the deficiency standard has identified special tools and equipment required for the standard inspection of the associated components, which may exceed the standard tools identified for the system. Level III Inspection Method Guide Sheets will address additional tools and equipment requirements that are specific to that particular method of advanced inspection. Inspectors should review these deficiency standards in order to determine any special tool requirements for subsystems they are to inspect.

## IX. LEVEL II INSPECTION METHOD KEYS

Certain observations will reference a Level II Inspection Method. The Facility Engineer will be able to identify deficiencies where a Level II inspection is flagged. The Level II Key at the observation level will refer to a specific guide sheet.

All Level II Guide Sheets are located at the end of each subsystem section. A Guide Sheet Reference Sheet precedes Level II and Level III Guide Sheets.

# 20 TRACKWORK

## X. LEVEL III INSPECTION METHOD KEYS

For Trackwork, Level III Inspection Methods shall include testing for internal rail defects. Testing rails for internal defects requires induction or ultrasonic test equipment. This type of testing equipment is available from several contracting sources.

All Level III Guide Sheets are located at the end of each subsystem section. A Guide Sheet Reference Sheet precedes Level II and Level III Guide Sheets.

## XI. REPLACEMENT COST

A replacement cost for each component type will be contained within the cost estimating system in the Site CAIS.

## XII. APPENDICES

**Appendix A - Abbreviations**

A summary and definition of all abbreviations used in this system are contained in Appendix A which is located at the end of Trackwork.

**Appendix B - Glossary**

A glossary of terms used in this system are contained in Appendix B which is located at the end of Trackwork.

**Appendix C - Life Cycles**

A listing of the average life cycle durations for each assembly* in the Standard.

**Note - Facility Manager's Guide**

The following are included in the Facility Manager's Guide:

A table showing the required manhours to perform the standard inspection for this facility listed by Cat Code (three digit).

A listing of all Level III inspections with their estimated cost and time to perform. This list will include frequency of inspection for time driven Level III's.

* Assembly is a term describing the level at which replacement rather than repair occurs. This can be at the subsystem or component designation, depending on the system being surveyed.

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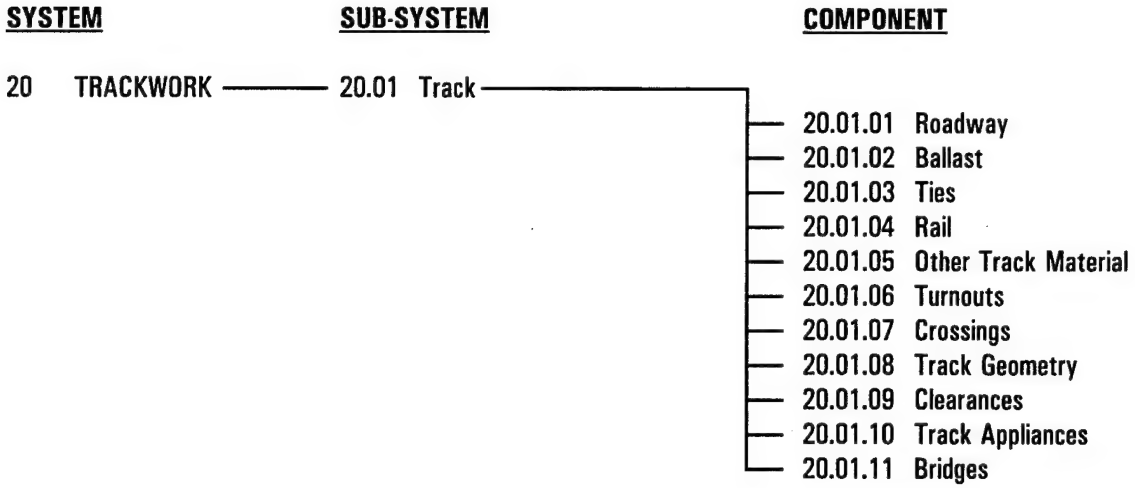
**Figure 20-A. WORK BREAKDOWN STRUCTURE**



# 20.01 TRACK

## DESCRIPTION

Trackwork provides the means for receiving and delivering loaded and empty freight cars to and from a connecting railroad. The railway facilities, as defined here, are the trackwork structure from the rails down including the roadbed, and also including special work, bridge decks and clearance. Another associated accessory includes flashing light signals located at road crossings.

## SPECIAL TOOLS AND EQUIPMENT REQUIREMENTS

No special tools are needed for the inspection of Track beyond the requirements listed in the Standard Tools Section.

## SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Track beyond the requirements listed in the Master Safety Plan and System Safety Section.

## COMPONENT LIST

- 20.01.01 ROADWAY
- 20.01.02 BALLAST
- 20.01.03 TIES
- 20.01.04 RAIL
- 20.01.05 OTHER TRACK MATERIAL
- 20.01.06 TURNOUTS
- 20.01.07 CROSSINGS
- 20.01.08 TRACK GEOMETRY
- 20.01.09 CLEARANCES
- 20.01.10 TRACK APPLIANCES
- 20.01.11 BRIDGES

## RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following sections should be reviewed for relevant and concurrent inspection activities.

| | |
|---|---|
| 19.00 | PAVEMENTS/IMPROVED SURFACES (all subsystems) |
| 16.00 | BRIDGES (all subsystems) |
| 29.00 | SITE ELECTRICAL (all subsystems) |

# 20.01 TRACK

## STANDARD INSPECTION PROCEDURE

The inspection shall be carried out by track segments, previously defined.

For a given track inspection section, the Total Quantity Measured numbers to be used during data input are as follows:

| COMPONENT | DEFECT | UOM | TOTAL QTY MEASURED |
|---|---|---|---|
| Roadway | All defects | LF | 195 LF |
| Ballast | All defects | TF | 195 LF |
| Ties | Ties | EA | 107 |
| | Tie Plates | EA | 214 |
| Rails | Broken Rail, Rail Base | EA | 5 |
| | Rail defects | LF | 390 LF |
| | Rail defects | EA | 10 |
| | Rail Ends/Joints | EA | 12 |
| Other Track Material | Tie Plate | EA | 212 |
| | Spikes (straight) | EA | 424 |
| | Spikes (curves) | EA | 636 |
| | Joint Bars | EA | 12 |
| | Rail Ends | EA | 12 |
| | Joint Bar Bolts | EA | 48 |
| | Rail Anchors | EA | 40 |
| Turnouts | All defects | EA | count in field |
| | Rail Braces | EA | 4 per side |
| Crossings | Defects | EA | 1 |
| | Bolts | EA | 8 per rail |
| Track Geometry | Gage, Alignment, Cross Level, Superelevation, Profile, Warp | EA | |
| Clearances | Clearances | EA | |
| Track Appliances | Scales | EA | 1 |

## 20.01 TRACK

For all other defects presented in the DS/IM that are not listed above, the inspector will need to determine the size or quantity of the items being examined to input the proper "Total Quantity Measured" number.

Inspection requires one inspector making visual observations on foot and taking some measurements such as track gage, cross level and other measurement using a 6-foot fold rule.

### COMPONENTS

### ◆ 20.01.01 ROADWAY

The track roadway is that portion of the track system, which includes the subgrade on which the ballast section and track are built, along with adjacent improvements and features required to support and maintain the railroad track. The roadway includes ditches running along the track and related drainage structures required to divert water past and away from the railroad. It also includes any embankment and cuts on which, or through which, the railroad is built and the vegetation covering the right-of-way and the ballast section.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Defective Road Bed:** The road bed is the prepared earth or soil on which the railroad ballast section and track structure are built. The subgrade is what ultimately supports the trains and if the subgrade does not have sufficient stability, it will be impossible to maintain proper track line, grade, and cross level. | | | |
| Observation: | | | |
| a. Channel erosion of embankment/slope. ***{Severity L} | LF | | |
| b. Settlement at end of bridge. ***{Severity M} | LF | | |
| c. Settlement of track. ***{Severity M} | LF | | |
| d. Erosion of ballast at end of ties. ***{Severity M} | LF | | |
| e. Embankment sliding/slippage. ***{Severity H} | LF | | |
| f. Track washout. ***{Severity H} | LF | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

### ◆ 20.01.01 ROADWAY (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Inadequate Drainage:**<br>A well-drained roadbed is essential to good track maintenance. Rain and ground water must be diverted away from embankments and into proper channels and culverts. Where fills cross depressions, water must not be allowed to accumulate and stand against the toe of the fill. | | | |
| Observation: | | | |
| a. Obstruction of drainage structures.<br>***{Severity M} | LF | | |
| b. Culvert has structural damage.<br>***{Severity H} | LF | | |
| c. Silt filled or partially filled culvert.<br>***{Severity H} | LF | | |

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Vegetation Interference:**<br>Vegetation which chokes tracks, ditches, and other facilities creates drainage and track maintenance problems, and can also result in safety hazards for personnel in executing their duties. Hazards which are covered by weeds cannot be readily seen and become tripping hazards. Brush covered signs and derails that cannot be observed may contribute to accidents. Drainage channels under bridges must be kept clear. Logs and other debris lodged against bridge piers increases the pressure against the bridge which could result in damage to the bridge. Brush and weed under timber bridges obstruct the flow and could result in fire damaging the bridge structure. | | | |
| Observation: | | | |
| a. Obstructing ballast drainage.<br>***{Severity L} | LF | | |
| b. Prevents track inspection.<br>***{Severity M} | LF | | |
| c. Hazard to bridge structures.<br>***{Severity M} | LF | | |
| d. Interferes with train operation.<br>***{Severity H} | LF | | |
| e. Obstructs visibility.<br>***{Severity H} | LF | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

### ◆ 20.01.02 BALLAST

Ballast is a selected crushed and graded aggregate which is placed upon the railroad roadbed for the purpose of providing drainage, stability, flexibility, uniform support for the rail and ties and the distribution of the track loads to the subgrade and facilitating maintenance. To provide track stability, the ballast must perform several well defined functions. The ballast must sustain and transmit static and dynamic loads in three directions (transverse, vertical and longitudinal) and distribute those loads uniformly over the subgrade. A prime function of the ballast is to drain the track system. The ballast must also perform a maintenance function to provide proper track alignment, cross level, and grade.

The ballast section should be clean, free-draining, and free of vegetation, soil, and other debris. In addition, the ballast materials should not cover or be at a level above the top of the ties.

| Defect: | UOM | LEVEL II KEY | LEVEL ■ KEY |
|---|---|---|---|
| *** Defective Ballast Conditions:** | | | |
| Observations: | | | |
| a. Dirty or fouled ballast. | TF | | |
| ***{Severity L} | | | |
| b. Pumping track. | TF | | |
| ***{Severity L} | | | |
| c. Insufficient shoulder ballast. | TF | | |
| ***{Severity L} | | | |
| d. Insufficient crib ballast. | TF | | |
| ***{Severity L} | | | |
| e. Center bound track. | TF | | |
| ***{Severity L} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

### ◆ 20.01.03 TIES

Ties serve the following functions: maintain gage, maintain track surface, maintain alignment and transmit the train weight to the ballast and then to the subgrade. Ties fall into four basic types: timber cross ties, timber switch ties, concrete ties and steel ties. Ties should be installed perpendicular to the rails and be properly tamped and spiked, with the top of the tie in full contact with the base of the rail and the bottom of the tie in full contact with the ballast.

Four consecutive defective ties require operating speed to not exceed 5 MPH. Five or more consecutive defective ties requires that no operation be allowed. When no operation is allowed, remedial action is required before track can be placed back in service. Joints shall be supported by at least one non-defective tie whose center line is within 18 inches of the rails end. At any location where a rail joint is not supported by at least one non-defective tie, operations will be reduced to a maximum of 10 MPH.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Missing or Displaced Timber Cross Ties:** Inspection will include examination of tie ends, the plate bearing areas, and the center top of the ties between the rails. Splits, checks, ring separations, crushing, shatter, and decay may be found at the tie end. The center of a tie is examined for decay or fracture. At the tie-plate bearing area, decay, plate cut, spike kill and crush may be found. | | | |
| Observation: | | | |
| a. Missing ties where center to center spacing along either rail is greater than 24 inches and less than 36 inches. | EA | | |
| ***{Severity L} | | | |
| b. Skewed ties where center to center spacing along either rail is greater than 24 inches and less than 36 inches. | EA | | |
| ***{Severity L} | | | |
| c. Missing ties where center to center spacing along either rail is greater than 36 inches and less than 48 inches. | EA | | |
| ***{Severity M} | | | |
| d. Skewed ties where center to center spacing along either rail is greater than 36 inches and less than 48 inches. | EA | | |
| ***{Severity M} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.03 TIES (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Missing or Displaced Timber Cross Ties (Continued):** | | | |
| e. Missing ties where center to center spacing along either rail is greater than 48 inches. | EA | | |
| ***{Severity H} | | | |
| f. Skewed ties where center to center spacing along either rail is greater than 48 inches. | EA | | |
| ***{Severity H} | | | |

**Defect:**

*** Deteriorated Cross Ties:**
Inspection will include examination of tie ends, the plate bearing areas, and the center top. Splits, checks, ring separations, crushing, shatter, and decay may be found at the tie end. The center of a tie is examined for decay or fracture. At the tie-plate bearing area, decay, plate cut, spike kill and crush may be found.

| Observation: | | | |
|---|---|---|---|
| a. Partial split beginning at the tie end. | EA | | |
| ***{Severity M} | | | |
| b. Tie is rotted, hollow or generally deteriorated at ends and center of tie. | EA | | |
| ***{Severity M} | | | |
| c. Derailment or dragging equipment damage where ties are cut within 12 inches of the base of the rail, frog or load bearing area to a depth of less than 2 inches. | EA | | |
| ***{Severity M} | | | |
| d. Broken tie either at the center or at the end generally under the rail. | EA | | |
| ***{Severity H} | | | |
| e. Split the length of the tie. | EA | | |
| ***{Severity H} | | | |
| f. Tie is rotted, hollow or generally deteriorated at bearing area of tie. | EA | | |
| ***{Severity H} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.03 TIES (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Deteriorated Cross Ties (Continued):** | | | |
| g. Derailment or dragging equipment damage where ties are cut within 12 inches of the base of the rail, frog or load bearing area to a depth of 2 inches or more. | EA | | |
| ***{Severity H} | | | |
| h. Burnt tie that is deteriorated to the point where substantial amount of the material is burnt or missing. | EA | | |
| ***{Severity H} | | | |

**Defect:**

*** Damaged Timber Cross Ties Tie Plates:**
Inspection will include examination of tie ends, the plate bearing areas, and the center top. Splits, checks, ring separations, crushing, shatter, and decay may be found at the tie end. The center of a tie is examined for decay or fracture. At the tie-plate bearing area, decay, plate cut, spike kill and crush may be found.

| Observation: | | | |
|---|---|---|---|
| a. Spike killed, spikes vertical loose. | EA | | |
| ***{Severity M} | | | |
| b. Tie plate or rail lateral movement 1/2 inches or less relative to the tie. | EA | | |
| ***{Severity M} | | | |
| c. Tie cut by the tie plate or the base of the rail less than 2 inches. | EA | | |
| ***{Severity M} | | | |
| d. Spike killed, spikes horizontally loose or lateral movement of rail. | EA | | |
| ***{Severity H} | | | |
| e. Tie plate or rail lateral movement greater than 2 inches relative to the tie. | EA | | |
| ***{Severity H} | | | |
| f. Tie cut by the tie plate or the base of rail more than 2 inches deep. | EA | | |
| ***{Severity H} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

### ◆ 20.01.03 TIES (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Damaged Concrete Cross Ties:** Inspection will include examination of tie ends, the plate bearing areas, and the center top. The ends, the center and the rail area are examined for breaks and stress crack. The rail bearing area is examined for failed or missing hold down devices. | | | |
| Observation: | | | |
| a. Missing Ties - center to center spacing along either rail is greater than 30 inches and less than 36 inches. | EA | | |
| ***{Severity L} | | | |
| b. Skewed Ties - center to center spacing along either rail is greater than 30 inches and less than 36 inches. | EA | | |
| ***{Severity L} | | | |
| c. Missing Ties - center to center spacing along either rail is greater than 36 inches and less than 48 inches. | EA | | |
| ***{Severity M} | | | |
| d. Skewed Ties - center to center spacing along either rail is greater than 36 inches and less than 48 inches. | EA | | |
| ***{Severity M} | | | |
| e. Broken Ties. | EA | | |
| ***{Severity H} | | | |
| f. Failed or missing hold down devices. | EA | | |
| ***{Severity H} | | | |
| g. Stress cracking of tie. | EA | | |
| ***{Severity H} | | | |
| h. Missing Ties - center to center spacing along either rail is greater than 48 inches. | EA | | |
| ***{Severity H} | | | |
| i. Skewed Ties - center to center spacing along either rail is greater than 48 inches | EA | | |
| ***{Severity H} | | | |

## 20.01 TRACK

### COMPONENTS (Continued)

◆ **20.01.03 TIES (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Damaged Steel Cross Ties:** Inspection will include examination of tie ends, the plate bearing areas, and the center top. The ends, the center and the rail area are examined for breaks and deterioration of the steel tie. The rail bearing area is examined for failed or missing hold down devices. | | | |
| Observation: | | | |
| a. Missing ties where center to center along either rail is greater than 24 inches and less than 36 inches. | EA | | |
| ***{Severity L} | | | |
| b. Skewed ties where center to center spacing along either rail is greater than 24 inches and less than 36 inches. | EA | | |
| ***{Severity L} | | | |
| c. Corroded tie. | EA | | |
| ***{Severity M} | | | |
| d. Missing ties where center to center along either rail is greater than 36 inches and less than 48 inches. | EA | | |
| ***{Severity M} | | | |
| e. Skewed ties where center to center spacing along either rail is greater than 36 inches and less than 48 inches. | EA | | |
| ***{Severity M} | | | |
| f. Broken ties. | EA | | |
| ***{Severity H} | | | |
| g. Bent ties. | EA | | |
| ***{Severity H} | | | |
| h. Failed or missing hold down devices. | EA | | |
| ***{Severity H} | | | |
| i. Missing ties where center to center along either rail is greater than 48 inches. | EA | | |
| ***{Severity H} | | | |
| j. Skewed ties where center to center spacing along either rail is greater than 48 inches. | EA | | |
| ***{Severity H} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.03 TIES (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Missing or Displaced Timber Switch Ties:** Inspection will include examination of tie ends, the plate bearing areas, and the center top. Splits, checks, ring separations, crushing, shatter, and decay may be found at the tie end. The center of a tie is examined for decay or fracture. At the tie-plate bearing area, decay, plate cut, spike kill and crush may be found. | | | |
| Observation: | | | |
| a. Missing ties where center to center spacing along either rail is greater than 24 inches and less than 36 inches. | EA | | |
| ***{Severity L} | | | |
| b. Skewed ties where center to center spacing along either rail is greater than 24 inches and less than 36 inches. | EA | | |
| ***{Severity L} | | | |
| c. Missing ties where center to center spacing along either rail is greater than 36 inches and less than 48 inches. | EA | | |
| ***{Severity M} | | | |
| d. Skewed ties where center to center spacing along either rail is greater than 36 inches and less than 48 inches. | EA | | |
| ***{Severity M} | | | |
| e. Missing ties where center to center spacing along either rail is greater than 48 inches. | EA | | |
| ***{Severity H} | | | |
| f. Skewed ties where center to center spacing along either rail is greater than 48 inches. | EA | | |
| ***{Severity H} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

### ◆ 20.01.03 TIES (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Deteriorated Timber Switch Ties:** Inspection will include examination of tie ends, the plate bearing areas, and the center top. Splits, checks, ring separations, crushing, shatter, and decay may be found at the tie end. The center of a tie is examined for decay or fracture. At the tie-plate bearing area, decay, plate cut, spike kill and crush may be found. | | | |
| Observation: | | | |
| a. Partial split beginning at the tie end. | EA | | |
| ***{Severity M} | | | |
| b. Tie is rotted, hollow or generally deteriorated at ends and center of tie. | EA | | |
| ***{Severity M} | | | |
| c. Derailment or dragging equipment damage where ties are cut within 12 inches of the base of the rail, frog or load bearing area to a depth of less than 2 inches. | EA | | |
| ***{Severity M} | | | |
| d. Broken switch tie either at the center or at the end generally under the rail. | EA | | |
| ***{Severity H} | | | |
| e. Split the length of the tie. | EA | | |
| ***{Severity H} | | | |
| f. Tie is rotted, hollow or generally deteriorated at bearing area of tie. | EA | | |
| ***{Severity H} | | | |
| g. Derailment or dragging equipment damage where ties are cut within 12 inches of the base of the rail, frog or load bearing area to a depth of 2 inches or more. | EA | | |
| ***{Severity H} | | | |
| h. Burnt tie that is deteriorated to the point where substantial amount of the material is burnt or missing. | EA | | |
| ***{Severity H} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.03 TIES (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Damaged Timber Ties at Tie Plates:** Inspection will include examination of tie ends, the plate bearing areas, and the center top. Splits, checks, ring separations, crushing, shatter, and decay may be found at the tie end. The center of a tie is examined for decay or fracture. At the tie-plate bearing area, decay, plate cut, spike kill and crush may be found. | | | |
| Observation: | | | |
| a. Spike killed, spikes vertical loose. | EA | | |
| ***{Severity M} | | | |
| b. Tie plate or rail lateral movement 1/2 inches or less relative to the tie. | EA | | |
| ***{Severity M} | | | |
| c. Tie cut by the tie plate or the base of the rail less than 2 inches. | EA | | |
| ***{Severity M} | | | |
| d. Spike killed, spikes horizontally loose or lateral movement of rail. | EA | | |
| ***{Severity H} | | | |
| e. Tie plate or rail lateral movement greater than 1/2 inch relative to the tie. | EA | | |
| ***{Severity H} | | | |
| f. Tie cut by the tie plate or the base of rail more than 2 inches deep. | EA | | |
| ***{Severity H} | | | |

## 20.01 TRACK

### COMPONENTS (Continued)

### ◆ 20.01.04 RAIL

Rails are the continuous steel guideways that support the rail equipment wheels. There are two basic types of defects in rail, external and internal. External defects are usually detected through visual inspection. Internal defects are rarely detected visually. Their detection usually requires the use of specialized non-destructive testing equipment.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Broken Rail:** | | | |
| Observation: | | | |
| a. A complete transverse separation of the head, web, and base of rail. | EA | | |
| ***{Severity H} | | | |
| b. A complete angular transverse separation of the head, web, and base of rail. | EA | | |
| ***{Severity H} | | | |

**Defect:**

| | | | |
|---|---|---|---|
| *** Broken Rail Base:** | | | |
| Observation: | | | |
| a. Broken base less than 6 inches long. | EA | | |
| ***{Severity M} | | | |
| b. Broken base 6 inches or greater in length. | EA | | |
| ***{Severity H} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.04 RAIL (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Corroded Rail Base:** Rail base corrosion can be measured by determining the distance between the tie plate and rail base (for double shoulder tie plate) or the distance between the tie plate and/or rail spike and the rail base (for single shoulder tie-plate). The sum of the measured distance on <u>both</u> sides of the rail base is considered to be the rail base corrosion measurement. If the base of the rail has corroded to the extent that greater than 1/4" play is allowed, then the rail must be removed. | | | |
| Observation: | | | |
| a. Corrosion 1/4 inch deep or less. | LF | | |
| ***{Severity L} | | | |
| b. Corrosion greater than 1/4 inch deep. | LF | | |
| ***{Severity H} | | | |
| **Defect:** | | | |
| *** Rail Corrugation:** | | | |
| Observation: | | | |
| a. A repeated wavelike pattern on the running surface of the rail. | LF | | |
| ***{Severity L} | | | |
| **Defect:** | | | |
| *** Crushed Head of Rail (Top):** | | | |
| Observation: | | | |
| a. Crushed head. | EA | | |
| ***{Severity M} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.04 RAIL (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** End Batter at Rail Joint:** End batter is a depression in the top surface of the railroad at the end of the rail. Rail end batter is measured 1/2 inch from the rail end with an 18-inch straightedge laid only along the top of the rail, and consists of the distance between the depressed surface of the rail and the bottom of the level. Train operations will be reduced to a maximum of 10 MPH if end batter exceeds 1/4 inch. | | | |
| Observation: | | | |
| a. End batter 1/4 inch deep or less. | EA | | 1 |
| ***{Severity L} | | | |
| b. End batter greater than 1/4 inch deep. | EA | | 1 |
| ***{Severity M} | | | |
| **Defect:** | | | |
| *** Engine Burn in Head of Rail:** Engine burn is measured at the midpoint of an 18-inch straightedge laid on the railhead over the defect. The measured distance is from the burned surface defect to the bottom of straight edge. | | | |
| Observation: | | | |
| a. Engine burn less than 1/4 inch in depth. | EA | | |
| ***{Severity L} | | | |
| b. Engine burn greater than 1/4 inch in depth. | EA | | |
| ***{Severity H} | | | |
| **Defect:** | | | |
| *** Flaking of Rail Head:** | | | |
| Observation: | | | |
| a. Flaking. | LF | | |
| ***{Severity L} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.04 RAIL (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Overflow of Rail Head:** | | | |
| Observation: | | | |
| a. Overflow on field side of rail. | LF | | |
| ***{Severity L} | | | |
| **Defect:** | | | |
| *** Short Rails:** | | | |
| Observation: | | | |
| a. Rails less than 13 feet. | EA | | |
| ***{Severity L} | | | |
| **Defect:** | | | |
| *** Running Surface Damage:** | | | |
| The depth of running surface damage is measured at the midpoint of an 18-inch straightedge laid on the railhead over the defect. The depth is measured from the rail surface at the defect to the bottom of straightedge. | | | |
| Observation: | | | |
| a. Surface depth 1/4 inch or less. | EA | | |
| ***{Severity L} | | | |
| b. Surface depth more than 1/4 inch. | EA | | |
| ***{Severity H} | | | |
| **Defect:** | | | |
| *** Shelling of Rail Head:** | | | |
| Observation: | | | |
| a. Shelling on gage side of rail. | LF | | |
| ***{Severity L} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.04 RAIL (Continued)**

| | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| **Defect:** | | | |
| *** Torch Cut Rail End:** Rail should not be flame cut in any manner. Rail should be cut using a railsaw or other appropriate cutting tool. | | | |
| Observation: | | | |
| a. Torch cut rail ends. | EA | | |
| ***{Severity M} | | | |
| **Defect:** | | | |
| *** Excessive Wear:** Note weight of rail is cast into rail web for identification purposes. | | | |
| Observation: | | | |
| a. Gage wear 1/2 inch or less for rail 90 pounds or larger. | LF | | 2 |
| ***{Severity M} | | | |
| b. Gage wear 3/8 inch or less for rail less than 90 pounds. | LF | | 2 |
| ***{Severity M} | | | |
| c. Head wear 1/2 inch or less for rail 90 pounds or larger. | LF | | 2 |
| ***{Severity M} | | | |
| d. Head wear 3/8 inch or less for rail less than 90 pounds. | LF | | 2 |
| ***{Severity M} | | | |
| e. Gage wear greater than 1/2 inch for rail 90 pounds or larger. | LF | | 2 |
| ***{Severity H} | | | |
| f. Gage wear greater than 3/8 inch for rail rail less than 90 pounds. | LF | | 2 |
| ***{Severity H} | | | |
| g. Head wear greater than 1/2 inch for rail 90 pounds or larger. | LF | | 2 |
| ***{Severity H} | | | |
| h. Head wear greater than 3/8 inch for rail less than 90 pounds. | LF | | 2 |
| ***{Severity H} | | | |

# 20.01 TRACK

## COMPONENTS (Continued)

### ◆ 20.01.05 OTHER TRACK MATERIAL

Other track material includes the following items: tie plates, track spikes, joint bars, compromise joint bars, insulated joint bars and bonds, boot legs and grounds. Items in Other Track Material which are of improper type, size, broken, or otherwise defective, should be replaced with the proper size and type material.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Damaged Tie Plate:** Tie plates distribute the vertical wheel loads to the tie and assist in holding the rail in position. Tie plates are of AREA design and may be either single or double shoulder. | | | |
| Observation: | | | |
| a. Broken/bent. | EA | | |
| ***{Severity L} | | | |
| b. Shoulder wear greater than 1/4". | EA | | |
| ***{Severity L} | | | |
| c. Missing. | EA | | |
| ***{Severity L} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.05 OTHER TRACK MATERIAL (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Defective Track Spikes:** In a typical application for timber ties with tie plates, one spike is driven at the base of the rail on the gage and field side. Spikes are typically driven with approximately 1/8-inch of space remaining between the head of the spike and the base of the rail. A proper spiking pattern requires that all gage spikes be opposite each other and that all field spikes be opposite each other; further, the spiking pattern shall be the same through the entire length of a track, such as all gage spike are ahead, up station. | | | |
| On curves 4 degrees and greater, a second spike is required on the field side of the rail, either at the base of the rail or as an anchor spike away from the base of the rail and opposite the gage spike. The preferred location for the hold down (anchor) spike is away from the base of the rail, but requires plates punched with 6 or 8 holes. | | | |
| Observation: | | | |
| a. Missing. | EA | | |
| ***{Severity L} | | | |
| b. Bent. | EA | | |
| ***{Severity L} | | | |
| c. Throat cut. | EA | | |
| ***{Severity L} | | | |
| d. Improper spiking pattern. | EA | | |
| ***{Severity L} | | | |
| e. Spike beneath the rail. | EA | | |
| ***{Severity L} | | | |

# 20.01 TRACK

## COMPONENTS (Continued)

### ◆ 20.01.05 OTHER TRACK MATERIAL (Continued)

**Joint Bars**

Track fitted with bolted rail is connected together by joint bars which are secured to both sides of the rail by bolts, spring washers and nuts. Joint bar bolts are installed such that the nuts are placed alternatively in succession on the inside and outside of the rail. Each joint is bolted with a minimum of two bolts in each rail.

Joint bars may not be altered by a flame/torch cut. Operations are not permitted over any location where both joint bars are broken.

**Standard Joint Bars:**

Rails of the same size, section and drilling pattern shall be joined together with standard joint bars. Standard joint bars are designed by weight of the rail and the rail section.

**Compromise Joint Bars:**

Rails of different size or section shall be joined together with compromise joint bars. Compromise bars are designed by weigh of rail, section and right hand and left hand. For the most part, compromise bars are designed to connect rails of different weighs and/or section.

**Insulated Joint Bars:**

Insulated joints are designed to arrest the flow of electric current from rail to rail, as at the end of a track circuit. The insulating material is usually fiberglass or other fiber insulating material. Some insulated joints use an epoxy adhesive to strengthen the joint; this is known as a bonded insulated joint.

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.05 OTHER TRACK MATERIAL (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Damaged Joint Bars:** | | | |
| Observation: | | | |
| a. Broken/cracked not at center. | EA | | |
| ***{Severity L} | | | |
| b. Loose joint bar(s). | PR | | |
| ***{Severity L} | | | |
| c. Improper size/type bars(s). | PR | | |
| ***{Severity L} | | | |
| d. Center cracked/broken/missing. | EA | | |
| ***{Severity M} | | | |
| e. Torch cut bar. | EA | | |
| ***{Severity M} | | | |
| f. Both bars broken. | PR | | |
| ***{Severity H} | | | |
| g. Both bars center cracked. | PR | | |
| ***{Severity H} | | | |
| **Defect:** | | | |
| *** Defective Rail Ends:** | | | |
| Observation: | | | |
| a. Rail end gap greater than 1" but less than 2". | EA | | 3 |
| ***{Severity M } | | | |
| b. Rail ends mismatched alignment greater than 3/16" but less than 1/4". | EA | | 3 |
| ***{Severity M} | | | |
| c. Rail end gap greater than 2". | EA | | 3 |
| ***{Severity H} | | | |
| d. Rail ends mismatched alignment greater than 1/4". | EA | | 3 |
| ***{Severity H} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.05 OTHER TRACK MATERIAL (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Defective Joint Bar Bolts:** A joint bar bolt is considered to be loose if the spring washer is not compressed closed and is not flat against the joint bar. | | | |
| Observation: | | | |
| a. Improper bolt pattern. | EA | | |
| ***{Severity L} | | | |
| b. Improper size/type bolt(s). | EA | | |
| ***{Severity L} | | | |
| c. Loose joint bolt(s). | EA | | |
| ***{Severity L} | | | |
| d. Missing/bent/cracked/broken bolt(s). | EA | | |
| ***{Severity L} | | | |
| e. All bolts in joint bar loose. | EA | | |
| ***{Severity M} | | | |
| f. One bolt per rail end. | EA | | |
| ***{Severity M} | | | |
| g. All bolts on a rail end missing/broken. | EA | | |
| ***{Severity H} | | | |
| **Defect:** | | | |
| *** Damaged Joint Bar Insulation:** | | | |
| Observation: | | | |
| a. Improperly applied insulation. | EA | | |
| ***{Severity L} | | | |
| b. Damaged/missing insulation. | EA | | |
| ***{Severity L} | | | |
| c. Damaged/missing end post. | EA | | |
| ***{Severity L} | | | |
| **Defect:** | | | |
| *** Rail Anchors:** Rail anchors are used to hold the rail in place and to help prevent longitudinal movement of the rail. Anchors are used to absorb and transfer the forces caused by longitudinal movement of the rail through the ties and roadbed. | | | |
| Observation: | | | |
| a. Improper size/type. | EA | | |
| *** {Severity M} | | | |
| b. Insecure/loose/improperly installed | EA | | |
| *** {Severity M} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

### ◆ 20.01.06 TURNOUTS

A turnout is an arrangement of a switch and a frog with guard and closure rails, by means of which trains may be diverted from one track to another. The switch is that part of a turnout used to divert rolling stock from one track to another. The frog is at the intersection of two running rails and is used to provide support for the wheels and passageways for their flanges, thus permitting wheels on either rail to cross the other. A guard rail is a short piece of rail, laid parallel with the running rail opposite the frog, used to prevent wheel flanges from striking the frog point. Closure rails connect the switch point rails and the frog.

The switch stand consists of a base, a spindle and a throwing lever. These are grouped together into a mechanism which transmits the motion of the lever arm to the switch connecting rod. The spindle is frequently equipped with a target to provide a distinctive indication.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Defective Switch Stands:** | | | |
| Observation: | | | |
| a. Insecure/loose/improperly installed. | EA | | |
| ***{Severity M} | | | |
| b. Missing/insecure/inoperative latch. | EA | | |
| ***{Severity M} | | | |
| c. Dirty/difficult to operate. | EA | | |
| ***{Severity H} | | | |
| d. Lateral movement of switch stand. | EA | | |
| ***{Severity H} | | | |

**Defect:**

*** Damaged Connecting Rod:**

| | | | |
|---|---|---|---|
| Observation: | | | |
| a. Improperly installed connecting rod. | EA | | |
| ***{Severity M} | | | |
| b. Damaged/bent connecting rod. | EA | | |
| ***{Severity M} | | | |
| c. Damaged bolts/missing cotter keys. | EA | | |
| ***{Severity M} | | | |
| d. Damaged/loose/missing jam nut. | EA | | |
| ***{Severity H} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.06 TURNOUTS (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Improper Switch Points:** Switch points are made of standard rails of the same section as the rail of the adjacent track. The switch point has a full section at the heel but is planed on the base through nearly its whole length, and planed along the stock rail side of the head through approximately one-half its length. | | | |
| Observation: | | | |
| a. Gaping 1/8" or greater. ***{Severity M} | EA | | 5 |
| b. Switch point higher than stock rail. ***{Severity M} | EA | | |
| c. Insecure/loose/improperly installed. ***{Severity M} | EA | | |
| d. Worn greater than 1/2" down and 6" back. ***{Severity H} | EA | | 4 |
| e. Gaping 1/4" or greater. ***{Severity H} | EA | | 5 |
| f. Point rail lower than stock rail beyond taper. ***{Severity H} | EA | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.06 TURNOUTS (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Defective Switch Rods:** The switch points are connected to each other by switch rods. The gage lines of the switch points at the first switch rod are separated a distance which is less than the gage of the track by the amount of the switch throw, which has been standardized as 4-3/4". | | | |
| Observation: | | | |
| a. Improper size/type. | EA | | |
| ***{Severity M} | | | |
| b. Insecure/loose/improperly installed. | EA | | |
| ***{Severity M} | | | |
| c. Damaged/missing. | EA | | |
| ***{Severity H} | | | |
| **Defect:** | | | |
| *** Defective Switch Rod Bolt:** | | | |
| Observation: | | | |
| a. Improper size/type bolt. | EA | | |
| ***{Severity M} | | | |
| b. Insecure/loose/improperly installed bolt. | EA | | |
| ***{Severity M} | | | |
| c. Damaged/missing bolt. | EA | | |
| ***{Severity H} | | | |
| **Defect:** | | | |
| *** Defective Heel Blocks:** The heel block is at the end of the switch point and maintains proper rail separation of 6-1/4 inches at the point known as the heel of switch. | | | |
| Observation: | | | |
| a. Improper size/type. | EA | | |
| ***{Severity M} | | | |
| b. Insecure/loose/improperly installed. | EA | | |
| ***{Severity M} | | | |
| c. Damaged/missing. | EA | | |
| ***{Severity H} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.06 TURNOUTS (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Defective Joint Bar:** | | | |
| Observation: | | | |
| a. Improper size/type joint bar(s). | EA | | |
| ***{Severity M} | | | |
| b. Insecure/loose/improperly installed joint bar. | EA | | |
| ***{Severity M} | | | |
| c. Damaged/missing bolt. | EA | | |
| ***{Severity H} | | | |
| **Defect:** | | | |
| *** Defective Joint Bar Bolt:** | | | |
| Observation: | | | |
| a. Improper size/type. | EA | | |
| ***{Severity M} | | | |
| b. Insecure/loose/improperly installed. | EA | | |
| ***{Severity M} | | | |
| c. Damaged/missing. | EA | | |
| ***{Severity M} | | | |
| **Defect:** | | | |
| *** Defective Stock Rails:** Each switch point is mated to a stock rail. A left hand turnout has a left hand bent stock rail and a right hand straight stock rail. A right hand turnout has a right hand bent stock rail and left hand straight stock rail. Defects shown are those that effect operations of the switch. Stock rails may also have the same defects as any other rail in the railroad system. | | | |
| Observation: | | | |
| a. Improper size/type. | LF | | |
| ***{Severity M} | | | |
| b. Insecure/loose/improperly installed. | LF | | |
| ***{Severity M} | | | |
| c. Overflow preventing proper closure. | LF | | |
| ***{Severity M} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.06 TURNOUTS (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|

*** Defective Rail Braces:**
Rail braces are of two types: adjustable and rigid. Braces perform an important function in the switch layout; they provide lateral support to the stock rails. This extra support is required for two reasons: first, the stock rail cannot be spiked on their gage side, and second, as the wheels are beginning to change direction through the switch, extra lateral forces are exerted against the point rail which is support by the stock rail.

Observation:
a. Improper size/type. EA
***{Severity M}
b. Insecure/loose/improperly installed. EA
***{Severity M}
c. Less than four per side. EA
***{Severity M}

**Defect:**

*** Defective Switch Plates:**
Switch plates maintain the required elevation of the switch points and provide a smooth surface upon which the points may move right or left. A riser in the slide plate provides a shoulder to prevent inward lateral movement of the stock rail. The stock rail is secured against outward movement by spiking the slide plate to the tie and by rail braces.

Observation:
a. Dirt/debris build up on switch plates. EA
***{Severity L}
b. Improper size/type. EA
***{Severity M}
c. Insecure/loose/improperly installed. EA
***{Severity M}

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.06 TURNOUTS (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Defective Frogs:** The frog is the component of the turnout that permits the equipment wheels to cross two intersecting rails. | | | |
| Observation: | | | |
| a. Flangeway depth greater than 1-1/2". ***{Severity M} | EA | | 8 |
| b. Flangeway width greater than 1-5/8". ***{Severity M} | EA | | 8 |
| c. Flangeway depth greater than 1-3/8". ***{Severity H} | EA | | 8 |
| d. Flangeway width greater than 1-1/2". ***{Severity H} | EA | | 8 |
| e. Point chipped/broken/worn greater than 5/8" down and 6" back. ***{Severity H} | EA | | 6 |
| f. Worn guarding face self guarded frog greater than 3/8". ***{Severity H} | EA | | 7 |
| **Defect:** | | | |
| *** Defective Frog Bolts:** | | | |
| Observation: | | | |
| a. Improper size/type. ***{Severity L} | EA | | |
| b. Insecure/loose/improperly installed. ***{Severity L} | EA | | |
| c. Damaged/missing. ***{Severity L} | EA | | |
| **Defect:** | | | |
| *** Defective Frog Plates:** | | | |
| Observation: | | | |
| a. Improper size/type. ***{Severity L} | EA | | |
| b. Insecure/loose/improperly installed. ***{Severity L} | EA | | |
| c. Damaged/missing. ***{Severity L} | EA | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

### ◆ 20.01.06 TURNOUTS (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Defective Guard Rails:** Guard rails are located at the frog on both outer rails. Their purpose is to prevent equipment wheels flanges from striking the frog point and possibly being routed in the wrong direction. Special plates and spacer blocks between the running rail and the guard rail maintain the proper flangeway and provides structural stability. | | | |
| Observation: | | | |
| a. Improper size/type. | EA | | |
| ***{Severity M} | | | |
| b. Insecure/loose/improperly installed. | EA | | |
| ***{Severity M} | | | |
| c. Guard rail flangeway width less than 1-5/8". | EA | | 8 |
| ***{Severity M} | | | |
| d. Guard check gage less than 54-1/4". | EA | | 9 |
| ***{Severity M} | | | |
| e. Guard face gage greater than 53-1/8". | EA | | 10 |
| ***{Severity M} | | | |
| f. Damaged/missing. | EA | | |
| ***{Severity H} | | | |
| g. Guard rail flangeway width less than 1-1/2". | EA | | 8 |
| ***{Severity H} | | | |
| h. Guard check gage less than 54-1/8". | EA | | 9 |
| ***{Severity H} | | | |
| i. Guard face gage greater than 53-1/4". | EA | | 10 |
| ***{Severity H} | | | |

**Defect:**

*** Defective Guard Rail Filler Block:**

| | | | |
|---|---|---|---|
| Observation: | | | |
| a. Improper size/type filler block. | EA | | |
| ***{Severity M} | | | |
| b. Insecure/loose/improperly installed filler block. | EA | | |
| ***{Severity M} | | | |
| c. Damaged/missing filler block. | EA | | |
| ***{Severity M} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.06 TURNOUTS (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Defective Guard Rail Bolts:** | | | |
| Observation: | | | |
| a. Improper size/type. | EA | | |
| ***{Severity L} | | | |
| b. Insecure/loose/improperly installed. | EA | | |
| ***{Severity L} | | | |
| c. Damaged/missing. | EA | | |
| ***{Severity L} | | | |
| **Defect:** | | | |
| *** Defective Guard Rail Plates:** | | | |
| a. Improper size/type. | EA | | |
| ***{Severity L} | | | |
| b. Insecure/loose/improperly installed. | EA | | |
| ***{Severity L} | | | |
| c. Damaged/missing. | EA | | |
| ***{Severity L} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

### ◆ 20.01.07 CROSSINGS

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Defective Railroad Crossing (Rail):** Rail crossings are a specially fabricated piece of trackwork designed to carry one track across another at the same grade. | | | |
| Observation: | | | |
| a. Debris in the flangeway. ***{Severity L} | EA | | |
| b. Guard check gage less than 54-1/4". ***{Severity M} | EA | | 12 |
| c. Guard face gage greater than 53-1/8". ***{Severity M} | EA | | 13 |
| d. Flangeway depth greater than 1-1/2". ***{Severity M} | EA | | 11 |
| e. Flangeway width greater than 1-5/8". ***{Severity M} | EA | | 11 |
| f. Guard check gage less than 54-1/8". ***{Severity H} | EA | | 12 |
| g. Guard face gage greater than 53-1/4". ***{Severity H} | EA | | 13 |
| h. Flangeway depth greater than 1-3/8". ***{Severity H} | EA | | 11 |
| i. Flangeway width greater than 1-1/2". ***{Severity H} | EA | | 11 |

**Defect:**

*** Defective Rail Crossing Filler Blocks:**

| Observation: | | | |
|---|---|---|---|
| a. Improper size/type filler block. ***{Severity M} | EA | | |
| b. Insecure/loose/improperly installed filler block. ***{Severity M} | EA | | |
| c. Damaged/missing filler block. ***{Severity M} | EA | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.07 CROSSINGS (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Defective Rail Crossing Bolts:** | | | |
| Observation: | | | |
| a. Improper size/type. | EA | | |
| ***{Severity L} | | | |
| b. Insecure/loose/improperly installed. | EA | | |
| ***{Severity L} | | | |
| c. Damaged/missing. | EA | | |
| ***{Severity L} | | | |
| **Defect:** | | | |
| *** Defective Rail Crossing Plates:** | | | |
| Observation: | | | |
| a. Improper size/type. | EA | | |
| ***{Severity L} | | | |
| b. Insecure/loose/improperly installed. | EA | | |
| ***{Severity L} | | | |
| c. Damaged/missing. | EA | | |
| ***{Severity L} | | | |
| **Defect:** | | | |
| *** Railroad Crossing (Road):** | | | |
| Railroad crossings are where roads, streets, or highways intersect the track at the same grade. There are several different types of railroad crossing materials that are commonly found on installations. These include: unsurfaced or dirt, rail, timber, asphalt, asphalt with timber headers, concrete and pre-manufactured rubber. The crossing surface should be maintained to provide a smooth crossing for vehicles and to prevent vehicle tires from striking the rails. The crossing surface should be maintained at an elevation less than or equal to 1/4 inch above the top of rails. | | | |
| Observation: | | | |
| a. Damaged/deteriorated crossing surface. | SF | | |
| ***{Severity L} | | | |
| b. Mismatched/separated surface. | SF | | |
| ***{Severity L} | | | |
| c. Flangeway width less than 2-1/2" or greater than 3". | LF | | |
| ***{Severity L} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.07 CROSSINGS (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Defective Railroad Crossing (Road) (Continued):** | | | |
| d. Flangeway width less than 1-3/4". | LF | | |
| ***{Severity M} | | | |
| e. Flangeway depth less than 2". | LF | | |
| ***{Severity M} | | | |
| f. Flangeway depth less than 1-1/2". | LF | | |
| ***{Severity M} | | | |
| g. Debris in the flangeway. | LF | | |
| ***{Severity M} | | | |
| h. Flangeway width less than 1-1/2". | LF | | |
| ***{Severity H} | | | |
| i. Flangeway depth less than 1-3/8". | LF | | |
| ***{Severity H} | | | |
| **Defect:** | | | |
| *** Defective Road Crossing Fastenings:** | | | |
| Observation: | | | |
| a. Insecure/loose/improperly installed lag screws/drive spikes. | EA | | |
| ***{Severity L} | | | |
| b. Damaged/missing lag screws/drive spikes. | EA | | |
| ***{Severity L} | | | |
| **Defect:** | | | |
| *** Inadequate Road Crossing Drainage:** | | | |
| Proper drainage of surface water away from the road crossing is essential to the satisfactory long-term performance to the track and the road. | | | |
| Observation: | | | |
| a. Pumping rails. | LF | | |
| ***{Severity L} | | | |
| b. Ponding water near or at the crossing. | LF | | |
| ***{Severity L} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

### ◆ 20.01.08 TRACK GEOMETRY

The term Track Geometry, as used herein, is used to describe deviations from the track's intended position.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Defective Track Gage:** Track gage measurement locations during inspections should include locations just ahead of switch points and at joints of curved closure rails in turnouts; at the point of the frog on both sides of turnouts and rail crossings; where there is a dark streak running along the field side of the top surface of the rail head; at locations where the ties are skewed badly; at road crossings; wherever wear marks indicate lateral movement of a tie plate; and in curves exceeding 12 degrees. | | | |
| Observation: | | | |
| a. Gage greater than 57-1/2". ***{Severity M} | EA | | 14 |
| b. Gage greater than 57-3/4". ***{Severity H} | EA | | 14 |
| c. Gage less than 56" or greater than 58". ***{Severity H} | EA | | 14 |

**Defect:**

*** Improper Track Alignment:**

Track alignment is measured at the midpoint of a 62-foot stringline stretched along the gage side of the line outside rail at the gage line (5/8 inch below top of rail). The alignment measurement is the distance, measured at a right angle, from the midpoint of the stringline to the gage side of the line outside rail. One inch measurement equals approximately one degree of curvature.

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.06 TURNOUTS (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Improper Track Alignment (Continued):** | | | |
| Observation: | | | |
| a. Alignment deviations tangent/ spirals/curves greater than 2". ***{Severity M} | EA | | 15 |
| b. Alignment deviations tangent/ spirals/curves greater than 4". ***{Severity H} | EA | | 15 |
| c. Alignment deviations tangent/ spirals/curves greater than 5". ***{Severity H} | EA | | 15 |

**Defect:**

*** Improper Cross Level:**
Cross level is the difference in elevation between the top surfaces of the two rails measured at right angles to the track. On tangent track the designated cross level is zero. On curved track the designated cross level is equal to the designated super elevation.

| | | | |
|---|---|---|---|
| Observation: | | | |
| a. Cross level deviations spirals greater than 1-1/2". ***{Severity M} | EA | | |
| b. Cross level deviations tangent/ curves greater than 1-1/2". ***{Severity M} | EA | | |
| c. Cross level difference tangent/ curves between spirals greater than 1-3/4". ***{Severity M} | EA | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

### ◆ 20.01.08 TRACK GEOMETRY

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Improper Cross Level (Continued):** | | | |
| d. Cross level deviations spirals greater than 1-3/4". ***{Severity H} | EA | | |
| e. Cross level deviations spirals greater than 2". ***{Severity H} | EA | | |
| f. Cross level deviations tangent/curves greater than 2-1/2". ***{Severity H} | EA | | |
| g. Cross level deviations tangent/curves greater than 3". ***{Severity H} | EA | | |
| h. Cross level difference tangent/ curves between spirals greater than 2-1/2". ***{Severity H} | EA | | |
| i. Cross level difference tangent/ curves between spirals greater than 3". ***{Severity H} | EA | | |

**Defect:**

*** Excessive Super-elevation:**
Super-elevation runoff should be at a uniform rate not exceeding 2 inches in any 31 feet of rail and should extend at least the full length of the spirals. For a curve, the outer rail may not be lower than the inside rail or have a super-elevation greater than 4 inches.

| Observation: | | | |
|---|---|---|---|
| a. Super-elevation run-off not at a uniform rate or exceeding 2" in any 31 feet. ***{Severity M} | EA | | 16 |
| b. Super-elevation greater than 4". ***{Severity H} | EA | | 16 |

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.08 TRACK GEOMETRY (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL ■ KEY |
|---|---|---|---|
| *** Deviated Track Profile:** Track profile is the relative elevation of the two rails along the track. Profile deviation is measured at the midpoint of a 62-foot stringline stretched along either rail. The profile deviation measurement is the distance (in inches) from the midpoint of the stringline to the top of rail. | | | |
| Observation: | | | |
| a. Deviation from uniform profile greater than 2-1/2". | EA | | 17 |
| ***{Severity M} | | | |
| b. Deviation from uniform profile greater than 2-3/4". | EA | | 17 |
| ***{Severity H} | | | |
| c. Deviation from uniform profile greater than 3". | EA | | 17 |
| ***{Severity H} | | | |

**Defect:**

*** Excessive Track Warp:**
Track warp is measured at rail joints using the line rail as the reference rail. Measure the crosslevel at any two points less than 62 feet apart. If the reference rail is lower than the opposite rail the sign of the measurement is negative (sign is positive if positions reversed). To determine warp either 1) subtract the smaller measurement from the larger measurement if the signs are the same; or 2) drop the signs and add the measurements if the signs are different.

| | | | |
|---|---|---|---|
| Observation: | | | |
| a. Greater than 1-3/4 inches. | EA | | 18 |
| ***{Severity L} | | | |
| b. Greater than 2-1/2 inches. | EA | | 18 |
| ***{Severity M} | | | |
| c. Greater than 3 inches. | EA | | 18 |
| ***{Severity H} | | | |

# 20.01 TRACK

## COMPONENTS (Continued)

### ◆ 20.01.09 CLEARANCES

Clearances refer to distances between tracks or over and along side of tracks which must be maintained free of any obstruction to provide for the safe passage of personnel or trains. Minimum horizontal and vertical clearances along a section of track are factors in establishing the maximum sign of locomotives, cars and loads which can be carried. Vertical clearance is measured vertically from the top surface of the rail. Horizontal (side) clearance is measured horizontally from the center line of the track.

| Defect: | UOM | LEVEL II KEY | LEVEL ■ KEY |
|---|---|---|---|
| *** Inadequate Horizontal Building Clearance:** Horizontal clearances for buildings and platforms are measured on either or both sides of the track from the centerline of the track. For curves, side clearances shall be increased 1-1/2" for each degree of curvature. When an obstruction is located adjacent to tangent track, but the track is curved within 80 feet of the obstruction, the side clearance will be increased by 3/8 inches for each degree of curvature. For each 20 feet, the tangent distance decreases the side clearance increases by 3/8 of an inch. | | | |
| Observation: | | | |
| a. Clearance less than 6'-2" for platforms up to 4' in height. | EA | | |
| ***{Severity L} | | | |
| b. Clearance less than 6'-2" for refrigerator car platforms up to 3'-3" high. | EA | | |
| ***{Severity L} | | | |
| c. Clearance less than 5' for low platforms less than 8" high. | EA | | |
| ***{Severity L} | | | |
| d. Clearance less than 8' for canopies less than 16' in height. | EA | | |
| ***{Severity L} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.09 CLEARANCES (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Inadequate Miscellaneous Horizontal Clearance:** | | | |
| Observation: | | | |
| a. Signs less than 8′ away. | EA | | |
| ***{Severity L} | | | |
| b. All loose, palleted and stacked materials less than 8′ away. | EA | | |
| ***{Severity L} | | | |
| c. Parked vehicles less than 8′ away. | EA | | |
| ***{Severity L} | | | |

**Defect:**

*** Inadequate Vertical Wire Clearance:**

Vertical clearances to wires and structures are measured vertically from the top of rail.

Observation:

a. Clearance less than 30′ for overhead wires greater than 15,000 volts. EA

***{Severity L}

b. Clearance less than 27′ for other overhead wires. EA

***{Severity L}

## 20.01 TRACK

**COMPONENTS (Continued)**

### ◆ 20.01.10 TRACK APPLIANCES

Track appliances includes mechanical and electronic scales, derails, bonds, boat legs and grounds.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Defective Mechanical Track Scales:** Mechanical track scales, and single draft scales, are the older method of determining weight where the entire car is spotted on the track scale, a weighmaster weighed the car, recorded the car number, the gross weight, and subtracted the light weigh of the car to arrive at the weigh of the lading. | | | |
| Observation: | | | |
| a. Dirty scale deck/substructure/pit. ***{Severity L} | EA | | |
| b. Defective pivots. ***{Severity M} | EA | | |
| c. Corroded pivot/bearings. ***{Severity M} | EA | | |
| d. Corrosion scale beam/ structural steel. ***{Severity M} | EA | | |
| e. Debris on deck. ***{Severity M} | EA | | |
| f. Defective weigh rails. ***{Severity H} | EA | | |
| g. Improper rail gap less than 1/8" or greater than 5/8". ***{Severity H} | EA | | |
| h. Out of date test. ***{Severity H} | EA | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

### ◆ 20.01.10 TRACK APPLIANCES (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Defective Electronic Scales:** Electronic scale, two draft scale, weighs one end of the car then the other, adds the weight and along with the car number transmits the data to a memory bank. This may be done while the cars are in motion, at slow speed, coupled or uncoupled. | | | |
| Observation: | | | |
| a. Dirty scale deck/substructure/pit. | EA | | |
| ***{Severity M} | | | |
| b. Debris on deck. | EA | | |
| ***{Severity M} | | | |
| c. Defective load cells. | EA | | |
| ***{Severity H} | | | |
| d. Out of date test. | EA | | |
| ***{Severity H} | | | |

**Defect:**

*** Defective Derails:**
A derails is a device employed to purposely derail a car or locomotive. The purpose of doing so is the protection of other cars or locomotives. The avoidance of a collision of a train against another train or against a car is paramount in the use of derails.

| Observation: | | | |
|---|---|---|---|
| a. Dirty. | EA | | |
| ***{Severity L} | | | |
| b. Insecure/loose/improperly installed. | EA | | |
| ***{Severity M} | | | |
| c. Insecure/loose/improperly installed connecting rod. | EA | | |
| ***{Severity M} | | | |
| d. Damaged/missing connecting rod. | EA | | |
| ***{Severity H} | | | |
| e. Insecure/loose/improperly installed connecting rod bolt. | EA | | |
| ***{Severity H} | | | |
| f. Damaged/missing connecting rod bolt. | EA | | |
| ***{Severity H} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

### ◆ 20.01.10 TRACK APPLIANCES (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Defective Bonds, Boot Legs and Grounds:** Bonding of rail serves several functions. One is for the continuity of the circuitry in signaled track, or for use in the circuitry for automatic road crossing protection and for use in circuitry required for grounding of tracks in preventing the discharge of static electricity in the loading and unloading of volatile liquids or solids. | | | |
| Observation: | | | |
| a. Corroded terminals. | EA | | |
| ***{Severity M} | | | |
| b. Missing/loose bonds. | EA | | |
| ***{Severity H} | | | |
| c. Missing/loose boot legs/connectors. | EA | | |
| ***{Severity H} | | | |
| d. Missing/damaged ground rods. | EA | | |
| ***{Severity H} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

### ◆ 20.01.11 BRIDGES

This section relates to the deck portion of railroad bridges inspection which includes the ties, guard rail and rails. Railroad bridges are of two basic types: open deck, and ballast deck.

**Open Deck Bridges**

Open deck bridges have bolts securing the ties to stringers which are attached to a pile bent or pier cap. On all open-floor railway bridges, the ties should be held securely in their proper spacing by a timber guard rail or a metal strap at or near both ends of the ties. Inner guard rails are to be steel rails not higher than the running rails, spaced about 10 inches inside the running rails. They should extend at least 50 feet beyond the end of the bridge. The ends should run to the center of the track and be beveled, bent down or otherwise protected against direct impact.

| Defect: | UOM | LEVEL II KEY | LEVEL ■ KEY |
|---|---|---|---|
| *** Defective Bridge Ties:** | | | |
| Observation: | | | |
| a. Two consecutive defective ties. | EA | | |
| ***{Severity L} | | | |
| b. Three consecutive defective ties. | EA | | |
| ***{Severity M} | | | |
| c. Less than one non-defective tie per rail joint. | EA | | |
| ***{Severity M} | | | |
| d. Four or more consecutive defective ties. | EA | | |
| ***{Severity H} | | | |
| **Defect:** | | | |
| *** Defective Bridge Guard Rail:** | | | |
| Observation: | | | |
| a. Defective inner guard rail. | LF | | |
| ***{Severity L} | | | |
| b. Defective timber guard rail. | LF | | |
| ***{Severity M} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.11 BRIDGES (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Defective Joint Bars:** | | | |
| Observation: | | | |
| a. Improper size/type. | EA | | |
| ***{Severity M} | | | |
| b. Insecure/loose improperly installed. | EA | | |
| ***{Severity M} | | | |
| c. Damaged/missing. | EA | | |
| ***{Severity H} | | | |
| **Defect:** | | | |
| *** Defective Line Bolts:** | | | |
| Observation: | | | |
| a. Insecure/loose/improperly installed line bolts. | EA | | |
| ***{Severity L} | | | |
| b. Damaged/missing line bolts. | EA | | |
| ***{Severity L} | | | |
| **Defect:** | | | |
| *** Defective Walkways** | | | |
| Observation: | | | |
| a. Defective walkway planks. | EA | | |
| ***{Severity M} | | | |
| b. Defective walkway ties. | EA | | |
| ***{Severity H} | | | |
| c. Defective handrail. | EA | | |
| ***{Severity H} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

### ◆ 20.01.11 BRIDGES (Continued)

**Ballast Deck Bridges**

On a ballast deck bridge the deck is a solid floor with a ballast section on top of the floor. The maintenance of track on the ballast deck is the same as that for normal track. Walkways along ballast deck bridges provide for safe walking over ballast deck bridges. Every fourth tie to be a long tie to support the walkway deck constructed of two-inch planking. Hand rail constructed at the outer edge of the platform will be either wood or steel post.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| * **Bridge Ties:** | | | |
| Observation: | | | |
| a. Two consecutive defective ties. | EA | | |
| ***{Severity L} | | | |
| b. Three consecutive defective ties. | EA | | |
| ***{Severity M} | | | |
| c. Less than one non-defective tie per rail joint. | EA | | |
| ***{Severity M} | | | |
| d. Four or more consecutive defective ties. | EA | | |
| ***{Severity H} | | | |
| **Defect:** | | | |
| * **Bridge Guard Rail:** | | | |
| Observation: | | | |
| a. Defective inner guard rail. | LF | | |
| ***{Severity L} | | | |
| b. Defective timber guard rail. | LF | | |
| ***{Severity M} | | | |
| **Defect:** | | | |
| * **Joint Bars:** | | | |
| Observation: | | | |
| a. Improper size/type. | EA | | |
| ***{Severity M} | | | |
| b. Insecure/loose/improperly installed. | EA | | |
| ***{Severity M} | | | |
| c. Damaged/missing. | EA | | |
| ***{Severity H} | | | |

## 20.01 TRACK

**COMPONENTS (Continued)**

◆ **20.01.11 BRIDGES (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|---|---|---|
| *** Bolts:** | | | |
| Observation: | | | |
| a. Insecure/loose/improperly installed. | EA | | |
| ***{Severity L} | | | |
| b. Damaged/missing. | EA | | |
| ***{Severity L} | | | |
| **Defect:** | | | |
| *** Drainage:** | | | |
| Observation: | | | |
| a. Defective drains. | EA | | |
| ***{Severity L} | | | |

# 20.01 TRACK

## REFERENCES

1. NAFVACINST 11230.1C, MO-103, MO 103.9
2. Technical Manual Army TM 5-628: Air Force AFR 91-44 Railroad Track Standards
3. American Railway Engineering Association (AREA), Manual for Railway Engineering
4. Code of Federal Regulations, Title 49, Part 213, Track Safety Standards
5. Railroad Engineering - Second Edition, William W. Hay

# 20.01 TRACK

| LEVEL II KEY | GUIDE SHEET CONTROL NUMBER |
|---|---|
| N/A | |

| LEVEL III KEY | GUIDE SHEET CONTROL NUMBER |
|---|---|
| 1 | GS-III 20.01.04-1 |
| 2 | GS-III 20.01.04-2 |
| 3 | GS-III 20.01.05-3 |
| 4 | GS-III 20.01.06-4 |
| 5 | GS-III 20.01.06-5 |
| 6 | GS-III 20.01.06-6 |
| 7 | GS-III 20.01.06-7 |
| 8 | GS-III 20.01.06-8 |
| 9 | GS-III 20.01.06-9 |
| 10 | GS-III 20.01.06-10 |
| 11 | GS-III 20.01.07-11 |
| 12 | GS-III 20.01.07-12 |
| 13 | GS-III 20.01.07-13 |
| 14 | GS-III 20.01.08-14 |
| 15 | GS-III 20.01.08-15 |
| 16 | GS-III 20.01.08-16 |
| 17 | GS-III 20.01.08-17 |
| 18 | GS-III 20.01.08-18 |

# LEVEL III INSPECTION METHOD GUIDE SHEET

## LEVEL III GUIDE SHEET - KEY NO.1

**COMPONENT:** RAIL
**CONTROL NUMBER:** GS-III 20.01.04-1

### Application

This guide applies to the measurement of rail batter at the end of a rail.

### Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

### Inspection Actions

Rails observed as being battered at the rail end shall be measured to determine the extent of the rail batter. Requires one person with an eighteen-inch straight edge and a rule or taper gage to measure the rail batter.

1. An eighteen inch straight edge is placed on the top of the batter rail end, with one end of the straight edge opposite and flush to the end of the rail.

2. End batter is the distance between the straight edge and the top of the rail measured at a point 1/2-inch from the end of the rail.

### Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section:

1. Eighteen-inch straight edge

### Recommended Inspection Frequency

Do a Level III inspection only when triggered by a Level I inspection.

### References

1. Technical Manual Army TM 5-628: Air Force AFR 91-44 Railroad Track Standards

2. American Railway Engineering Association (AREA), Manual for Railway Engineering

3. Code of Federal Regulations, Title 49, Part 213, Track Safety Standards

# LEVEL III INSPECTION METHOD GUIDE SHEET

## LEVEL III GUIDE SHEET - KEY NO.2

**COMPONENT** RAIL
**CONTROL NUMBER:** GS-III 20.01.04-2

### Application

This guide applies to the measurements of head wear of a rail.

### Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

### Inspection Actions

On rail suspected of being worn more than the allowance provided; wear measurements shall be taken at the center and at each end of the rail not more than one foot from the end of the of the joint bar. Requires one person with an outside caliper to measure rail wear.

1. Vertical, top head, wear shall be measured at the center line of the web of the rail using calipers. These measurement are to be compared to the pattern rail height dimensions for the rail section being measured.

2. Horizontal, side head, wear shall be measured at the gage line of the rail head using calipers. These measurements are to be compared to the rail pattern head dimensions for the rail section being measured.

### Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section:

1. Outside calipers

### Recommended Inspection Frequency

Do a Level III inspection only when triggered by a Level I inspection.

### References

1. Technical Manual Army TM 5-628: Air Force AFR 91-44 Railroad Track Standards

2. American Railway Engineering Association (AREA), Manual for Railway Engineering

3. Code of Federal Regulations, Title 49, Part 213, Track Safety Standards

# LEVEL III INSPECTION METHOD GUIDE SHEET

## LEVEL III GUIDE SHEET - KEY NO.3

**COMPONENT:** OTHER TRACK MATERIAL
**CONTROL NUMBER:** GS-III 20.01.05-3

### Application

This guide applies to the measurement of the alignment of rail ends at joint bars.

### Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

### Inspection Actions

When a gap or a mismatch is observed between the rail ends at the joint, measurements are required. Requires one person to measure either the rail gap or the mismatch of rail at the joint bars, when bolts are tight, using a six-foot folding rule.

1. Gap between the rail ends is measured to determine the distance in inches between the rail ends.

2. Rail ends are measured at the joint bars to determine the mismatch between the top running surface and/or the mismatch on the gage side of the rails.

### Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section:

1. Six-foot rule

### Recommended Inspection Frequency

Do a Level III inspection only when triggered by a Level I inspection.

### References

1. Technical Manual Army TM 5-628: Air Force AFR 91-44: Railroad Track Standards

2. American Railway Engineering Association (AREA), Manual for Railway Engineering

3. Code of Federal Regulations, Title 49, Part 213, Track Safety Standards

# LEVEL III INSPECTION METHOD GUIDE SHEET

## LEVEL III GUIDE SHEET - KEY NO.4

**COMPONENT:** TURNOUTS
**CONTROL NUMBER:** GS-III 20.01.06-4

### Application

This guide applies to the measurement of wear at the point of a switch point.

### Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

### Inspection Actions

Switch points showing wear shall be measured. Measurement requires one person using an eighteen-inch straight edge and a rule.

1. Place an eighteen-inch straight edge on the top of the switch point with one end of the straight edge opposite the end of the switch point.

2. Measure the length of the worn surface from the end of the switch point back and the depth of the wear at a point 1/2 inch back from the end of the switch point.

### Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section:

1. Eighteen-inch straight edge

### Recommended Inspection Frequency

Do a Level III inspection only when triggered by a Level I inspection.

### References

1. Technical Manual Army TM 5-628: Air Force AFR 91-44 Railroad Track Standards

2. American Railway Engineering Association (AREA), Manual for Railway Engineering

3. Code of Federal Regulations, Title 49, Part 213, Track Safety Standards

# LEVEL III INSPECTION METHOD GUIDE SHEET

## LEVEL III GUIDE SHEET - KEY NO.5

**COMPONENT:** TURNOUTS
**CONTROL NUMBER:** GS-III 20.01.06-5

### Application

This guide applies to the adjustment and the gaping of a switch point.

### Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

### Inspection Actions

When throwing a switch in either direction, if the point gaps or little or no resistance is felt further inspection is required. Measurement requires one person to operate the switch stand to throw the switch points and a second person to place the spacer between the switch point and the stock rail.

1. Place an 1/8-inch spacer between the stock rail and the switch point. If the switch can be thrown and locked with the spacer between the stock rail and the switch point in either direction, remedial action is required.

2. Place a 1/4-inch spacer between the stock rail and the switch point. If the switch can be thrown and locked with the spacer between the stock rail and the switch point in either direction, remedial action is required.

### Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section:

1. Spacers 1/8 and 1/4 inches thick

### Recommended Inspection Frequency

Do a Level III inspection only when triggered by a Level I inspection.

### References

1. Technical Manual Army TM 5-628: Air Force AFR 91-44 Railroad Track Standards

2. American Railway Engineering Association (AREA), Manual for Railway Engineering

3. Code of Federal Regulations, Title 49, Part 213, Track Safety Standards

# LEVEL III INSPECTION METHOD GUIDE SHEET

## LEVEL III GUIDE SHEET - KEY NO.6

**COMPONENT:** TURNOUTS
**CONTROL NUMBER:** GS-III 20.01.06-6

### Application

This guide applies to the measurement of a worn frog point.

### Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

### Inspection Actions

Frog points showing wear shall be measured to determine the extent of wear. Measurement requires one person using an eighteen-inch straight edge and rule to measure the wear at the frog point.

1. An eighteen-inch straight edge is placed on top of the frog point, with one end at or near the actual point of frog. Both the horizontal wear distance and the vertical wear are measured.

2. If the frog point is worn more than six-inches back and a half-inch down, remedial action is required.

### Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section:

1. Eighteen-inch straight edge.

### Recommended Inspection Frequency

Do a Level III inspection only when triggered by a Level I inspection.

### References

1. Technical Manual Army TM 5-628: Air Force AFR 91-44 Railroad Track Standards

2. American Railway Engineering Association (AREA), Manual for Railway Engineering

3. Code of Federal Regulations, Title 49, Part 213, Track Safety Standards

# LEVEL III INSPECTION METHOD GUIDE SHEET

## LEVEL III GUIDE SHEET - KEY NO.7

**COMPONENT:** TURNOUTS
**CONTROL NUMBER:** GS-III 20.01.06-7

### Application

This guide applies to measurement of wear on the guarding face of a self-guarded frog.

### Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

### Inspection Actions

Self guarded frog showing wear on the guarding face of the self guarded frog shall be measured. Measurements require one person with an outside reading calipers to measure the guarding face.

1. With a pair of calipers, measure the thickness of the raised guarding surface, opposite the point, of a self guarded frog.

### Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section:

1. Outside calipers

### Recommended Inspection Frequency

Do a Level III inspection only when triggered by a Level I inspection.

### References

1. Technical Manual Army TM 5-628: Air Force AFR 91-44 Railroad Track Standards
2. American Railway Engineering Association (AREA), Manual for Railway Engineering
3. Code of Federal Regulations, Title 49, Part 213, Track Safety Standards

# LEVEL III INSPECTION METHOD GUIDE SHEET

## LEVEL III GUIDE SHEET - KEY NO.8

**COMPONENT:** TURNOUTS
**CONTROL NUMBER:** GS-III 20.01.06-8

### Application

This guide applies to the measurement flangeways for turnout frogs and rail crossing.

### Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

### Inspection Actions

Turnout frogs showing wear are to be measured to determine the width and depth of the flangeway on both sides of the point. Rail crossing showing wear are measured at several location in the area between the running rail and the guarding rail. Measurement requires one person using a folding or a 6-inch steel rule.

1. The depth of the flangeway is measured from the top of the running surface to the bottom of the flangeway.

2. The width of the flangeway for turnouts is measured between the gage line of the frog point and the wing rails opposite the frog point long rails or casting. The width for rail crossing is measured between the running rail and the guarding rail.

### Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section:

1. 6-inch steel rule

### Recommended Inspection Frequency

Do a Level III inspection only when triggered by a Level I inspection.

### References

1. Technical Manual Army TM 5-628: Air Force AFR 91-44: Railroad Track Standards

2. American Railway Engineering Association (AREA), Manual for Railway Engineering

3. Code of Federal Regulations, Title 49, Part 213, Track Safety Standards

# LEVEL III INSPECTION METHOD GUIDE SHEET

## LEVEL III GUIDE SHEET - KEY NO.9

**COMPONENT:** TURNOUTS
**CONTROL NUMBER:** GS-III 20.01.06-9

### Application

This guide applies to the measurement of the distance between the gage line and the face of the guarding face for turnout frogs and rail crossing.

### Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

### Inspection Actions

During the inspection of turnouts and rail crossing the guard check gage shall be measured. Requires one person using a combination level/gage.

1. Measurements, for turnouts, are taken from frog point rail or casting near the point of frog to guard face of the guard rail.

2. Measurements, for rail crossings, are taken at several locations at right angles to the gage line of the running rail and the guard face of the guarding rail.

### Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section:

1. Combination level/gage

### Recommended Inspection Frequency

Do a Level III inspection only when triggered by a Level I inspection.

### References

1. Technical Manual Army TM 5-628: Air Force AFR 91-44: Railroad Track Standards

2. American Railway Engineering Association (AREA), Manual for Railway Engineering

3. Code of Federal Regulations, Title 49, Part 213, Track Safety Standards

# LEVEL III INSPECTION METHOD GUIDE SHEET

## LEVEL III GUIDE SHEET - KEY NO.10

**COMPONENT:** TURNOUTS
**CONTROL NUMBER:** GS-III 20.01.06-10

### Application

This guide applies to the measurement of the guard face distance for turnout frogs and rail crossing.

### Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

### Inspection Actions

During the inspection of turnout the guard face distance shall be measured. Requires one person using a combination level/gage.

1. Measurement is taken from frog wing rail or casting near the point of frog to guard face of the guard rail.

2. Measurements for rail crossing are taken at right angles to the guarding faces.

### Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section:

1. Combination level/gage

### Recommended Inspection Frequency

Do a Level III inspection only when triggered by a Level I inspection.

### References

1. Technical Manual Army TM 5-628: Air Force AFR 91-44: Railroad Track Standards

2. American Railway Engineering Association (AREA), Manual for Railway Engineering

3. Code of Federal Regulations, Title 49, Part 213, Track Safety Standards

# LEVEL III INSPECTION METHOD GUIDE SHEET

## LEVEL III GUIDE SHEET - KEY NO.11

**COMPONENT:** CROSSINGS
**CONTROL NUMBER:** GS-III 20.01.07-11

### Application

This guide applies to the measurement flangeways for turnout frogs and rail crossing.

### Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

### Inspection Actions

Turnout frogs showing wear are to be measured to determine the width and depth of the flangeway on both sides of the point. Rail crossing showing wear are measured at several location in the area between the running rail and the guarding rail. Measurement requires one person using a folding or a 6-inch steel rule.

1. The depth of the flangeway is measured from the top of the running surface to the bottom of the flangeway.

2. The width of the flangeway for turnouts is measured between the gage line of the frog point and the wing rails opposite the frog point long rails or casting. The width for rail crossing is measured between the running rail and the guarding rail.

### Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section:

1. 6-inch steel rule

### Recommended Inspection Frequency

Do a Level III inspection only when triggered by a Level I inspection.

### References

1. Technical Manual Army TM 5-628: Air Force AFR 91-44: Railroad Track Standards

2. American Railway Engineering Association (AREA), Manual for Railway Engineering

3. Code of Federal Regulations, Title 49, Part 213, Track Safety Standards

# LEVEL III INSPECTION METHOD GUIDE SHEET

## LEVEL III GUIDE SHEET - KEY NO.12

**COMPONENT:** CROSSINGS
**CONTROL NUMBER:** GS-III 20.01.07-12

### Application

This guide applies to the measurement of the distance between the gage line and the face of the guarding face for turnout frogs and rail crossing.

### Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

### Inspection Actions

During the inspection of turnouts and rail crossing the guard check gage shall be measured. Requires one person using a combination level/gage.

1. Measurements, for turnouts, are taken from frog point rail or casting near the point of frog to guard face of the guard rail.

2. Measurements, for rail crossings, are taken at several locations at right angles to the gage line of the running rail and the guard face of the guarding rail.

### Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section:

1. Combination level/gage

### Recommended Inspection Frequency

Do a Level III inspection only when triggered by a Level I inspection.

### References

1. Technical Manual Army TM 5-628: Air Force AFR 91-44: Railroad Track Standards

2. American Railway Engineering Association (AREA), Manual for Railway Engineering

3. Code of Federal Regulations, Title 49, Part 213, Track Safety Standards

# LEVEL III INSPECTION METHOD GUIDE SHEET

## LEVEL III GUIDE SHEET - KEY NO.13

**COMPONENT:** CROSSINGS
**CONTROL NUMBER:** GS-III 20.01.07-13

### Application

This guide applies to the measurement of the guard face distance for turnout frogs and rail crossing.

### Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

### Inspection Actions

During the inspection of turnout the guard face distance shall be measured. Requires one person using a combination level/gage.

1. Measurement is taken from frog wing rail or casting near the point of frog to guard face of the guard rail.

2. Measurements for rail crossing are taken at right angles to the guarding faces.

### Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section:

1. Combination level/gage

### Recommended Inspection Frequency

Do a Level III inspection only when triggered by a Level I inspection.

### References

1. Technical Manual Army TM 5-628: Air Force AFR 91-44: Railroad Track Standards

2. American Railway Engineering Association (AREA), Manual for Railway Engineering

3. Code of Federal Regulations, Title 49, Part 213, Track Safety Standards

# LEVEL III INSPECTION METHOD GUIDE SHEET

## LEVEL III GUIDE SHEET - KEY NO.14

**COMPONENT:** TRACK GEOMETRY
**CONTROL NUMBER:** GS-III 20.01.08-14

### Application

This guide applies to measurement of the gage of tangent and curved track, turnout and rail crossings.

### Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

### Inspection Actions

During inspection track gage shall be checked a minimum of every 1,000 feet of tangent track or when visual inspection indicates that the gage has changed. All turnouts and rail crossing shall be checked. Measurements require one person with a combination level/ gage.

1. Tangent and curved track gage is measured at right angle to the gage line.
2. Turnouts are measured at right angle to the gage line at the locations.
3. Rail crossing are measured at right angle to the gage line at several locations within the rail crossing.

### Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section:

1. Combination level/gage

### Recommended Inspection Frequency

Do a Level III inspection only when triggered by a Level I inspection.

### References

1. Technical Manual Army TM 5-628: Air Force AFR 91-44 Railroad Track Standards
2. American Railway Engineering Association (AREA), Manual for Railway Engineering
3. Code of Federal Regulations, Title 49, Part 213, Track Safety Standards

# LEVEL III INSPECTION METHOD GUIDE SHEET

## LEVEL III GUIDE SHEET - KEY NO.15

**COMPONENT:** TRACK GEOMETRY
**CONTROL NUMBER:** GS-III 20.01.08-15

### Application

This guide applies to measurements for track alignment.

### Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

### Inspection Actions

When deviation in track alignment are observed, track shall be measured to determine the deviation from the intended alignment. Requires three persons using a 62-foot stringline and a six-foot folding rule.

1. Alignment is measured at the midpoint of a 62-foot stringline stretched along the gage side of the line rail at the gage line.

2. The designated alignment for tangent track is zero. In spirals, the change in curvature shall be at a uniform rate. For curved track, the designated alignment is the degree of curvature.

### Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section:

1. 62-foot stringline (option stringline holder)

### Recommended Inspection Frequency

Do a Level III inspection only when triggered by a Level I inspection.

### References

1. Technical Manual Army TM 5-628: Air Force AFR 91-44 Railroad Track Standards

2. American Railway Engineering Association (AREA), Manual for Railway Engineering

3. Code of Federal Regulations, Title 49, Part 213, Track Safety Standards

# LEVEL III INSPECTION METHOD GUIDE SHEET

## LEVEL III GUIDE SHEET - KEY NO.16

**COMPONENT:** TRACK GEOMETRY
**CONTROL NUMBER:** GS-III 20.01.08-16

### Application

This guide applies to measurements for track super elevation of curves.

### Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

### Inspection Actions

Super elevation is measured at several locations along the curves portion of the track. If the degree of curve is known, one person using a combination level/gage is required. If the degree of curve is not known, it can be determined by three persons using a 62-foot stringline.

1. The measured super elevation is compared to the values found in Table 1 to determine the maximum allowable operating speed.

2. Allowable super elevation may be calculated using the formula found in Table 1.

### Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section:

1. Combination level/gage

### Recommended Inspection Frequency

Do a Level III inspection only when triggered by a Level I inspection.

### References

1. Technical Manual Army TM 5-628: Air Force AFR 91-44 Railroad Track Standards

2. American Railway Engineering Association (AREA), Manual for Railway Engineering

3. Code of Federal Regulations, Title 49, Part 213, Track Safety Standards

# LEVEL III INSPECTION METHOD GUIDE SHEET

## LEVEL III GUIDE SHEET - KEY NO.17

**COMPONENT:** TRACK GEOMETRY
**CONTROL NUMBER:** GS-III 20.01.08-17

### Application

This guide applies to measurements of track profile of either rail.

### Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

### Inspection Actions

When deviation in the uniform profile of rails are observed, profile of the track shall be made. Requires three persons using a 62-foot stringline to measure deviations in the profile along the top of a rail.

1. Profile deviation is measured by stretching a 62-foot chord along the top of the rail and measuring the deviation on either rail at the midpoint of the 62-foot chord.

### Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section:

1. 62-foot stringline (option stringline holder)

### Recommended Inspection Frequency

Do a Level III inspection only when triggered by a Level I inspection.

### References

1. Technical Manual Army TM 5-628: Air Force AFR 91-44 Railroad Track Standards
2. American Railway Engineering Association (AREA), Manual for Railway Engineering
3. Code of Federal Regulations, Title 49, Part 213, Track Safety Standards

# LEVEL III INSPECTION METHOD GUIDE SHEET

## LEVEL III GUIDE SHEET - KEY NO.18

**COMPONENT:** TRACK GEOMETRY
**CONTROL NUMBER:** GS-III 20.01.08-18

### Application

This guide applies to the measurement of the track cross level or warp.

### Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

### Inspection Actions

Where track pumping and a jointy track condition is observed, additional cross level readings shall be taken.

1. Measure the cross level at any two points less than 62 feet apart; often a series of cross level reading are taken at or near joints. If the reference rail is lower than the opposite rail, the sign of the measurement is negative (-). If the reference rail is higher than the opposite rail, the sign of the measurement is positive (+).

2. To determine warp: If both signs are the same, drop the signs and subtract the smaller measurement from the larger measurement. If the signs are different, drop the signs and add the measurements.

### Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section:

1. Combination level/gage

### Recommended Inspection Frequency

Do a Level III inspection only when triggered by a Level I inspection.

### References

1. Technical Manual Army TM 5-628: Air Force AFR 91-44 Railroad Track Standards

2. American Railway Engineering Association (AREA), Manual for Railway Engineering

3. Code of Federal Regulations, Title 49, Part 213, Track Safety Standards

# APPENDIX A

## ABBREVIATIONS

| | |
|---|---|
| AREA | American Railway Engineering Association |
| EA | Each |
| GS-II | Guide Sheet, Level II Inspection Method |
| GS-III | Guide Sheet, Level III Inspection Method |
| JT | Joint Bar |
| LF | Linear Feet |
| NAVFAC | Naval Facilities Command |
| PR | Pair |
| SF | Square Feet |
| TF | Track Feet |
| UOM | Unit of Measure |
| " | Inch |
| ' | Feet |
| < | Less Than |
| > | Greater Than |
| =< | Equal to or Less Than |

# APPENDIX B

## GLOSSARY

| | |
|---|---|
| Alignment | The horizontal location of a railroad as described by curves and tangents. |
| Ballast | Ballast is a selected crushed and graded aggregate material which is placed upon the roadbed for the purpose of providing drainage, stability, flexibility, uniform support for the rail and the ties and distribution of the track loading to the subgrade and facilitating maintenance. |
| Bolt Hole Crack | A progressive fracture which originates at a bolt hole and progresses away from the hole usually at an angle or along a path other than perpendicular or longitudinal line. Usually the result of unusual stresses along the edge of the bolt from the bolt itself. |
| Branch Line | The secondary line or lines of a railway. |
| Broken Base | A progressive fracture in the base of the rail, with a vertical separation or split. The separation is substantially longitudinal, but usually turns to the edge of the base. |
| Broken Rail Square | A complete transverse separation of the head, web, and base of the rail. May be as a hairline crack running around the rail at the break with one or both of the rail ends battered down. |
| Closure Rail | The rails between the parts of any special trackwork layout, as the rails between the switch and the frog in a turnout; also the rails connecting the frogs of a crossing or of an adjacent crossing, but not forming parts thereof. |
| Compound Fissure | A progressive fracture originating in a horizontal split head which turns up or down in the head of the rail as a smooth, bright or dark surface progressing until substantially at a right angle to the length of the rail. |
| Compromise Joint | A joint for uniting ends of contiguous rails of different section, or of rails of the same section but of different drilling. |
| Corroded Base | The decaying or corroding of the metal on the web or base of the rail which results in irregular pits or cavities. Can be recognized as pits or cavities on the upper base or web of the rail. Severest corrosion usually occurs underneath the base of the rail and is, therefore, not visible whenever the rail is in place in track and not visible at all in road crossings. |
| Crossing (Track) | A structure used where one track crosses another at grade, and consisting of four connecting frogs. |

## APPENDIX B

| | |
|---|---|
| Cross Level | The difference in elevation between the top surfaces of the two rails measured at right angles to the track. |
| Crushed Head | A flattening of several inches of the rail head, usually accompanied by a crushing down of the metal but with no signs of cracking in the fillet under the head. Appearance in track; flattening and widening of the head for several inches, with the entire head sagging; small cracks in the depression on the running surface; in advanced stages, creep or bleeding may be present at the fillet under the head. |
| Curve, Degree of | For railroads, the angle subtended at the center of a simple curve by a 100 foot chord. |
| Curve, Easement | A curve whose degree varies either uniformly or in some definitely determined manner so as to give a gradual transition between a tangent and a simple curve, which it connects, or between two simple curves. |
| Curve, Simple | A continuous change in direction of alignment by means of an arc of a single radius. |
| Curve, Vertical | An easement curve in the track to connect intersecting grade lines. |
| Derail | A track structure for derailing rolling stock in case of emergency. |
| Detail Fracture | A progressive fracture at or near the surface of the rail head. Head checks in the upper gage corner of the rail which may have shelling spots or flaking. |
| End Batter | Damage caused by wheels striking the rail ends.Appears as damage to or a depression in the top surface of the rail head at the end of the rail. |
| Engine Burn | Rail that has been scarred on the running surface by friction of slipping locomotive wheels. Round or oval rough spots or holes on the tread of the running surface. Often the source of engine burn fractures. |
| Engine Burn Fracture | A progressive fracture in the head of the rail, starting from an engine wheel burn, with transverse separation at right angles to the running surface. It is usually found with a shallow horizontal separation where the zone of burned metal separates from the metal just below the surface. No sign of a transverse separation is visible until the defect reaches the rail surface. |
| Fastenings | Joint bars, bolts and spikes |

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| Fastenings(Auxiliary) | Nutlocks, spring washers, tie plates, rail braces and anti-creeping devices. |
| Flaking | A progressive horizontal separation on the running surface near the gage corner often accompanied by scaling or chipping. Flaking should not be confused with shelling as flaking occurs only on the running surface near the gage corner and is not as deep as shelling. Flaking is not a critical defect. |
| Flangeway | The open way through a track structure which provides passageway for wheel flange. The depth of the wheel flange passageway is the vertical distance from the top of the tread surface to the top of the filler or separator introduced between the tread portion and the guard portion of a track structure. The flangeway width is the distance between the gage line and the guard line of a track structure, which provides a passageway for wheel flanges. |
| Frog | A track structure used at the intersection of two running rails to provide support for wheels and passageways for their flanges, thus permitting wheels on either rail to cross the other. |
| Gage | The distance between the gage lines, measured at right angles to the rails. Standard gage is 4 feet 8 1/2 inches. A gage is also a tool or devise to measure or establish the gage of the track. |
| Gage Line | A line 5/8 inches below the top of rail along the side nearer the center of the track. |
| Grade Rail | The grade rail is the reference from which superelevation is applied to the outside rail of a curve. The inside rail is always designated as the grade rail of a curve. |
| Guard Check Gage | The distance between guard lines, measured across the track at right angles to the gage lines. |
| Guard Face Gage | The distance between guard lines and gage line, measured across the track at right angles to the gage line. |
| Guard Line | A line 5/8 inches below the top of rail along that side of the flangeway which is nearest the center of the track. |
| Guard Rail | A rail or other structure laid parallel with the running rail of a track to prevent wheels from being derailed; or to hold wheels in correct alignment to prevent wheel flanges from striking the points of turnouts or crossing frogs or the point of switch. A rail or other structure laid parallel with the running rails of a track to keep derailed wheels adjacent to the running rail. |

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| Head Web Separation | A longitudinally separation of the head from the web of the rail at head fillet area. Originating in the head fillet at the end of the and can be attributed to stresses of an unusual nature from underneath the rail head. |
| Heel Spread | The distance, at the heel, between the gage line of a switch rail and the gage line of the stock rail. For a straight switch this has been standardized to 6-1/4 inches. |
| Heel of Switch | That end of a switch rail that is the farther from its point, and nearer the frog. |
| Insulation | A devise or material that prevents the flow of electric current in a track circuit from passing from one rail to other or through switches and other track structures. |
| Joint Bar | A steel member, embodying beam-strength and stiffness in its structural shape and material; commonly used in pairs for the purpose of joining rail ends together, and holding them accurately, evenly and firmly in position with reference to surface and gage-side alignment. |
| Joint Insulated | A rail joint designed to arrest the flow of electric current from rail to rail by means of insulation so placed as to separate the rail ends and other metal parts connecting them. |
| Line Rail | The line rail is used to establish the alignment of the track. The line rail can be either rail on tangent track as long as the same rail is used for the entire length of the tangent. For curves, the outside rail is always the line rail. |
| Main Line | The principal line or lines of a railway system. |
| Minimum Rail Length | Any rail less than 13 feet in length should be replaced by a rail not less than 13 feet in length. |
| Overflow | A rolling out of the thread metal beyond the field corner with no break down of the underside of the head. Flow is not a critical defect.<br>a. Surface metal on the head flowed toward the field side giving a creased appearance on the running surface near the field corner.<br>b. A protruding lip extending along the length of the rail.<br>c. In the advanced stage, flow becomes blade like, jagged, or nonuniform and may hang down or separate from the rail head. |

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| Passing Track | A track which is auxiliary to the main track, for meeting or passing trains. |
| Piped Rail | A vertical split in a rail, usually the web, with a vertical separation or seam which open up into a cavity, in an advanced stage of development, a wide longitudinal seam or cavity inside the web, which extends vertical toward the head and base of the rail. |
| Point of Switch | That end of the switch rail which is the further from the frog; the point where the spread between the gage lines of the stock rail and the switch rail is sufficient for a particular switch point. |
| Point Rail | The tapered rail of a split switch. |
| Point Rail Rise | The elevation of a switch rail to allow the overhanging part of a hollowed-out treads of worn wheels to pass over the stock rail. |
| Rail | A rolled steel shape, commonly a T-section, designed to be laid end to end in two parallel lines on cross ties or other suitable supports to form a track for railway rolling stock. |
| Rail Brace | A metal shape designed to fit the contour of the side of the stock rail and extend over the switch, with provision for fastening through the plate to the tie, to restrain the movement of the stock rail. Rail braces are either rigid or adjustable. Adjustable rail braces may be adjusted laterally with respect to the stock rail, to compensate for variations in the dimensions of the rail and to permit adjusting for wear. |
| Running Surface Damage | Any damage to the surface of the rail, both the running surface and the external surfaces, caused by deep engine burns or by striking the rail. Surface damage is not normally a critical defect but may lead to detail fractures or engine burn fractures. |
| Shelling | A progressive horizontal separation which may crack out at any level on the gage side but generally at the gage corner. It extends longitudinally not as a true horizontal or vertical crack, but at an angle related to the amount of rail wear. Shelling is not a critical defect.<br><br>Appears in the track as one or more of the following:<br>a. Dark spots irregularly spaced on the gage side of the running rail.<br>b. Longitudinal separation at one or several levels in the upper gage corner with discoloration from bleeding.<br>c. If the rail has been turned, the shelly spots will appear on the field side with an irregular overhanging lip of metal similar to flowed rail. |

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| Special Trackwork | All rails, track structures and fittings, other than plain unguarded track that is either curved nor fabricated before laying. |
| Spike Kill | Spikes which cannot or have not been advanced fully into the underlying railroad tie for various reasons. |
| Split Head Horizontal | A progressive defect originating inside of the rail head, usually 1/4-inch or more below the running surface and progressing horizontally in all directions, and generally accompanied by a flat spot on the running surface. The defect appears as a crack lengthwise with the rail when it reaches the side of the rail head. |
| Split Head Vertical | A vertical split through or near the middle of the head, and extending into or through it. A Crack or rust streak may show under the head close to the web or pieces may be split off the side of the head. |
| Split Web | A progressive fracture through the web, which develops in a longitudinal or transverse direction, or both. Horizontal or vertical bleeding cracks in the web, may be visible. |
| Spur | A stub track diverging from a main or other track. |
| Stock Rail | A running rail against which the switch point rail operates. |
| Stock Rail Bend | The bend or set which must be given the stock rail to compensate for variations in the dimensions of the rail and to permit of adjusting for wear. |
| Superelevation | The vertical distance that the outer rail is over the inner rail. |
| Switch | A track structure used to divert rolling stock from one track to another. |
| Switch Angle | The angle between the gage lines of the switch rail and the stock rail. |
| Switch, Split | A switch consisting essentially of two movable point rails with the necessary fixtures. |
| Switch Stand | A device for the manual operation of switches. |
| Tie Plate | A plate interposed between the rail or other track structure and a tie. The tie plate can be either the single shoulder type or double shoulder type. |
| Torch Cut Bolt Holes | Any rail that is cut or otherwise modified using acetylene torch or other open flame. Appears as an irregular or rough bolt holes. |

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| Torch Cut Rail End | Any rail that is cut or otherwise modified using acetylene torch or other open flame. Appears as an irregular or rough rail end. |
| Track | An assembly of rails, ties and fastenings over which cars, locomotives and trains are moved. |
| Track Bolt | A bolt with a button head and oval, or elliptical, neck and a threaded not designed to fasten together rails and joint bars. |
| Track Profile | Track profile is the relative elevation of the two rails along the track. |
| Transverse Fissure | A progressive crosswise fracture starting from the center or nucleus inside the head of the rail, then spreading outward substantially at right angles to the running surface of the rail. |
| Turnout | An arrangement of a switch and a frog with closure rails, by which rolling stock may be diverted from one track to another. |
| Warp | The difference in crosslevel between any two points spaced less than or equal to 62 feet apart. |
| Wear | Rail wear measurements shall consist of a vertical head wear (head wear) measurement and a side wear (gage wear) measurement. Vertical head wear is measured at the center of the rail. Horizontal head wear (gage wear) is measured at point 5/8 inches below the top of the rail. |
| Weld Defects | A progressive transverse separation within an area where two rails have been joined by welding or a rupture at a weld where improper fusion has occurred. No outward sign is visible until the separation reaches the rail surface. A defective weld may then be recognized by a vertical bleeding crack at the welded portion of the rail joint where separation has reached the surface. |

# APPENDIX C

## LIFE CYCLE

## 20 TRACKWORK

## 20.01 TRACKWORK

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| Track Rail | 100 YRS |
| Track Cross Ties | 35 YRS |

Source:
Railroad Engineering - Second Edition, William W. Hay